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JOURNAL
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THE PROGRESS OF FOREST ENTOMOLOGY IN THE UNITED STATES[1]

ABSTRACT

A biographical sketch of Dr. A. D. Hopkins, the father of forest entomology in this country, whose studies established the great economic importance of forest insects, the percentage principle of control, the host selection principle, some of the possibilities in silvicultural control and business management and the value of the Bioclimatic Law as a guide in control work. The application of these investigations is exemplified by the studies of assistants to Dr. Hopkins, W. F. Fiske on the gipsy moth, Dr. F. C. Craighead on the locust borer, and Dr. T. E. Snyder on white ants. There is great need for further investigations along these lines and for the closest cooperation between forester and forest entomologists in developing silvicultural methods and modifications in mangement.

On July 12, 1923, Dr. A. D. Hopkins who has been in charge of forest insect investigations of the Bureau since July 1902 was, in accordance with his expressed wishes, transferred from his former duties to that of special research in bioclimatics.

Dr. Hopkins enters a field extremely important and interesting, relatively new and with a wide and direct entomological bearing. He leaves behind a science of which, in its application to American types of forests, he has been the father and pioneer. It is fitting and proper at this time to give a brief biographical sketch of Dr. Hopkins, to summarize briefly his great achievements in Forest Entomology and to outline the most notable contributions.

BIOGRAPHICAL. Dr. Hopkins was born August 20, 1857, on a farm at Evans, near Ripley, Jackson Co., West Virginia. From his earliest recollection he was interested in and made collections of, first, land shells and, in succession, water shells, bird eggs, birds, and finally insects, and has, since he was about 12 years old to the present time, specialized on insects. Some work he did on the farm with an insect affecting raspberries, including original drawings to illustrate the insect, its work and

[1]A contribution by members of the Division of Forest Entomology of the Bureau of Entomology, U. S. Department of Agriculture.

its parasites, led to his appointment in 1890 to a position on the staff of the West Virginia University Agricultural Experiment Station.

His love of and indefatigable efforts to understand nature had by this time equipped him in extraordinary fashion for the life he was to follow. As State Entomologist Dr. Hopkins immediately gave evidence of his insight into the entomological problems of the forest and his deep interest in them. He showed the broad knowledge of entomology that leads to a recognition of the value of systematic and biological investigations in their application to economic entomology, building up a collection and a reputation for keenness of vision in the warfare between insects and man. Surely the recognition of forest entomology as a branch of science developed as his accomplishments increased.

In the autumn of 1892 he was sent on a misssion to Germany to find a beetle that would be predaceous on the barkbeetle (*Dendroctonus frontalis* Zimm.) that was killing the pine and spruce timber of West Virginia and adjoining states. The mission, as to the attainment of the object of finding the beetle (*Clerus formicarius* Linn.) was a success as described in Bulletin 56, West Virginia Agricultural Experiment Station, 1899. In recognition of this the Board of Regents of the West Virginia University honored him with a degree of Doctor of Philosophy.

In 1899 he was employed by the U. S. Division of Entomology (now Bureau) to make entomological explorations in the Pacific Coast and Northern Rocky Mountain forests; in 1900 to make a similar exploration in the spruce forests of Maine; and in 1901 to make a special investigation of depredations by tree-killing insects in the Black Hills of South Dakota. In recognition of services on these special missions, and as foremost forest entomologist in America, Dr. Hopkins was, on July 1, 1902, appointed Chief of Forest Insect Investigations in the Bureau of Entomology, which position he has held to the present time.

Dr. Hopkins' first activities as Forest Entomologist consisted of extensive preliminary surveys of the character and extent of the most important depredations by forest insects throughout the country. The results of these surveys and additional studies convinced him of the primary necessity for studies of the Scolytid barkbeetles, especially those in the genus *Dendroctonus*, many species of which he found to be new and the most destructive enemies of coniferous forests in this country.

Since about 1895 Dr. Hopkins has been interested in broad biological questions and in 1900 announced the recognition of a natural law. Of late years he has devoted much time to the development of this law

which is now known as the Bioclimatic Law, a law of life and climate as related to geographical distribution of plants and animals, life and climate zones, etc. To this work Dr. Hopkins expects to devote the rest of his life.

As to his school education, Dr. Hopkins has often regretted that it was limited to the common schools of his native county but for 57 years he has been a student and investigator with nature as his teacher and feels that, although yet a student, he has gained knowledge and experience equaled by few college graduates.

FOREST ENTOMOLOGY IN AMERICA. Forest entomology in the United States was relatively new. Intensive investigation of forest insects being only about a quarter of a century old and so different from the forest entomology in Europe, not only in the types of insects involved but also in the environmental conditions which govern the forests, an almost entirely new problem was to be solved. Furthermore, the value of forest and forest products, as compared with other agricultural crops, was still too small a proportion of our national resources and income for it to receive its full share of support, although our forests, by virtue of their just right, are demanding an ever increasing amount of attention and concern. Nevertheless, in spite of this comparatively short period of research and relatively poor support, much has been done by forest entomologists under the lead of Dr. Hopkins in this country and it is only fitting that what has been accomplished should be recognized in this country as abroad. During the past twelve years many of the British colonial forest entomologists have visited the United States Bureau of Entomology to study methods of combating forest insects.

The destructiveness of forest insects in the United States was early realized by Dr. Hopkins and other forest entomologists and foresters. However, it was found difficult to overcome the popular opinion that barkbeetles were secondary in attack as in Europe and to educate people into realizing their serious primary nature. In the United States certain barkbeetles (species of *Dendroctonus*) are absolutely primary and concentrate on the largest and best timber. They cannot be combated in the same manner as can insects that attack only weakened trees. But Dr. Hopkins was of the opinion from the first that forest insects could be controlled!

The investigators of forest insects in the United States have been considerably retarded in their efforts and progress by lack of financial support. The appropriations for forest insect control have never been equal to those for the control of insects injurious to other crops. Leav-

ing aside appropriations by the states, $30,000 per year has been the average annual appropriation for the Division of Forest Insects of the Federal Bureau of Entomology and this, despite the fact that forest insects undoubtedly kill more merchantable timber in coniferous forests than does fire, for the control of which there are large annual appropriations by federal, state and private timber owners.

Despite this shortage of funds, Dr. Hopkins and his assistants have given due attention to those phases of the subject which have been deemed most important, such as tree-killing barkbeetles and insects injurious to forest products, where there was most need and demand by owners for control methods.

In addition, very complete biological investigations of the principal forest insects of the United States have been made by forest entomologists of the federal and state governments and effective methods of control have been determined for many of the most injurious species.

Foremost, among the many notable contributions made by Dr. Hopkins to the science of forest entomology are the following broad principles regarding the work of combating forest insects in America:

Economic Principles of Forest Entomology

First, *artificial methods* of controlling destructive barkbeetles which include, (a) *the percentage principle of control* by which it is only necessary that enough of the depredating insects be destroyed to turn the balance in favor of their natural enemies; and (b) *the host selection principle* by which it is possible to control an insect attacking a valuable host tree without reference to those in a less valuable host, due to the adaptation of the insect to the host upon which it has fed for many years and the subsequent confinement of its attack to that host.

Second, *silvicultural control and business management*, which will provide for the care of standing timber and the handling of crude and finished products in such a manner as to bring about unfavorable conditions for attack by the more destructive insects. This includes the use of pure stands to prevent the attacks of certain defoliators and mixed stands in other cases; the removal of slash only where logging operations are sporadic or of short duration; and in the case of timber products the utilization of natural elements such as solar heat and water.

Third, the *Bioclimatic Law* as a guide to (a) the proper dates and periods to apply a remedy in any given locality, (b) determine the natural distribution of an insect and (c) the sections of a state or country where artificial distribution from another country or an infested section in this country would be most *dangerous* as related to a destructive insect or most *useful* as related to a beneficial one.

These principles which embody in part silvicultural and forest management practices are being tried out on a large scale and if, after sufficient test, they prove true, they are the most important and economical principles ever advocated. Without such principles in certain inacces-

sible areas of the country, control work against forest insects could never be undertaken.

Artificial control embodying these principles has been carried on extensively both in the east and in our western forests and has resulted in the saving of millions of feet of standing commercial timber from destruction by insects. The control projects which have been instituted on these principles by the Forest Service, Park and Indian Services, state and private owners are too numerous to mention but the success of the methods has been well established.

Removal of 50% to 75% of the infested timber brings about a reduction in the loss of from 60% to 80% in the first year and, as has been recently demonstrated in Southern Oregon and Northern California on the largest project yet undertaken, at a cost which leaves a profit at the end of the first year's work.

On a project in Northeastern Oregon from 1910 to 1913, as a result of extensive and intensive investigations, Dr. Hopkins was able to prove that a case of long standing epidemic infestation of *Dendroctonus monticolae* Hopk. in inferior species of timber such as lodgepole pine will *not* migrate to any extent to another and more valuable host such as yellow pine, although the stands are adjacent and intermingled. This is extremely valuable data since control work in lodgepole pine, especially in inaccessible areas, is often impractical.

Contributions by Assistants of Dr. A. D. Hopkins

Along the line of silvicultural control much important work has already been done. W. F. Fiske, a former assistant of Dr. Hopkins, in 1913, after a study of the favorable food plants of the gipsy moth, advocated pure stands of trees which were unfavorable to the gipsy moth larvae, or in association with less favored food plants. He also found that mixed stands of oak and white pine were only slightly less susceptible to serious damage than pure stands of oak which is the favorite food plant. This was the real beginning of silvicultural control work in this country, although it has long been known to foresters and forest entomologists that, in general, pure stands are more susceptible to their particular enemies than mixed stands. The main difficulties to be encountered in practices embodying pure stands or mixed stands are to be found in the fact that, while a pure stand of one forest tree will be practically immune to the insect for which one recommendation is made, it offers in its turn an exceptional opportunity for wholesale loss from another insect. Hence, it can be readily seen that studies over many years must be made before positive instructions regarding silvicultural

practices from the entomological viewpoint will be available. Indeed, with only a short period of study—some twenty-five years—no more positive results can be expected if they are to be considered as authoritative.

There is no doubt but what similar studies to those made by Dr. F. C. Craighead, a former specialist on forest entomology under Dr. Hopkins, and his successor as Forest Entomologist, on the locust borer could be done with other forest insects, even though it is not yet entirely proven to the satisfaction of foresters and entomologists that this method is entirely effective in the case of the locust borer. Much more work should be done with the locust borer to thoroughly prove that shading the trunks will prevent attack by sunlight-loving beetles.

Notable host plant studies were made by Craighead, and J. M. Miller has made valuable contributions to our knowledge of forest-tree-seed destroying insects.

Along other lines studies have been made by Dr. Hopkins and members of his staff on the periodicity of attack by barkbeetles, endemic and epidemic conditions, distances of flight, slash disposal, solar heat control, etc., and much valuable data accumulated.

Methods for the control of insects injurious to both crude and finished forest products have been determined. Special treatments, such as chemical wood preservatives, sprays, and determination of effective kiln drying temperatures, etc., have been developed by Dr. T. E. Snyder and are in effective use, even to the extent of enabling American manufacturers to compete with foreigners for trade in the Tropics with chemically treated, "white-ant-proof" furniture, etc. Snyder discovered that Lyctus powder post beetles lay their eggs in the pores of wood. By closing these pores by the use of any ordinary filler, attack by these insects can be prevented.

The most important and economical methods, however, are those first recommended by Dr. Hopkins, i. e. of management. With a knowledge of the biology of the insects, it has been possible to slightly change the methods of handling timber so as to create unfavorable conditions for attack by insects. By simple methods of classification of stock in piling, periodical inspection, and utilization of the older stock first, injury to seasoned hardwood lumber and products by *Lyctus* powder post beetles can be and is being prevented, resulting in the saving of enormous stores of hardwood for the Army and Navy.

Certain termites require moisture—shut off from the ground, their source of moisture, by proper construction they will dry up. The

natural forces can be utilized and by rapid transportation of green saw logs from the woods into the water at the mill pond or to sites in full sunlight, as worked out by Dr. Craighead and other members of the division of Forest Insects, damage by borers and ambrosia beetles can be prevented. Green lumber can be protected from attack by the removal of bark edges and loose piling.

Future Needs

While Dr. Hopkins and his staff of forest entomologists have chiefly concerned themselves with what have been deemed the most important and most pressing demands from timber holders for information on the insect enemies of forests, tree-killing barkbeetles that take a large annual toll in healthy merchantable timber, and insects infesting forest products where handling has increased the value of the material; it is true that there exist many problems of comparatively lesser importance which still remain to be solved. Among the most important of these are the defoliators. However, it is also true that this type of insect forms the most fluctuating and least constant menace. The caterpillars and false caterpillars responsible for those sporadic losses which are admittedly great are still not truly constant primary enemies of the great bulk of our timber. Death of the defoliated trees is sometimes due to secondary attack. As a consequence, the defoliators have, for economic reasons, had to yield to the continuous pressure of their more dangerous and destructive rivals.

Close cooperation between foresters and forest entomologists in the study of the possibility of silvicultural and management methods of control of these defoliating insects—as has been begun in Canada—will yield valuable results.

Summary

Dr. Hopkins has contributed to the progress of the science of Forest Entomology in at least three distinct ways: He has advanced to a remarkable extent our knowledge of tree-killing beetles as systematist, biologist and morphologist on Scolytid beetles of the world, on which he is recognized as a world authority; established principles of fundamental importance for the economic control of forest insects; organized, led and developed an extraordinary staff of assistants and specialists in the various fields of Forest Entomology. Indeed in the latter connection, while he himself leaves this field the work in which he has so aided, there remain many workers, who, guided and inspired by him, have added much to the knowledge of the problems of Forest Entomology. We may look

to these co-workers, many of whom have not been mentioned and due credit given in this brief account, to continue the work on forest insects so well begun by Dr. Hopkins and we hope that in his newer field Dr. Hopkins will meet with the same success that attended his efforts in Forest Entomology!

THOS. E. SNYDER, *Entomologist.*
WILLIAM MIDDLETON *Assistant Entomologist.*
F. P. KEEN, *Assistant Entomologist.*

Washington, D. C., August 28, 1923.

SEASONAL ADAPTATION OF A NORTHERN HEMISPHERE INSECT TO THE SOUTHERN HEMISPHERE

By JOHN C. HAMLIN, *Officer-in-Charge Prickly-pear Investigations, Commonwealth Prickly-pear Board*

ABSTRACT

Melitara junctolineella Hulst (Order Lepidoptera, Family Pyralidae), one of the several insects introduced into Australia in connection with the attempt biologically to control the prickly-pear pest, is indigenous to North America. In southern Texas it produces two generations annually. Its brood adjustment to seasons was upset by departure from our winter and immediate entry into the summer of the Southern Hemisphere. During the period it has been accomplishing its swing-over to the opposite seasons of Australia three generations have been produced in sixteen months. Complete adjustment to the Australian seasons has not yet obtained but observations indicate that in its ultimate adaptation to the opposite seasons it will have three broods yearly.

On the one hand it is common knowledge that certain species of insects have more or less broods per year as the summer is longer or shorter. On the contrary there is evidence to show that certain species cease activities at certain periods regardless of the conditions of temperature and moisture to which they may be subjected. These instances, however, apply to insects living on the one or the other side of the equator.

When first entering upon duty for the Australian Commonwealth Government, I made many conjectures as to the manner in which certain species from the Northern Hemisphere would adjust themselves to the opposite seasons of the Southern Hemisphere; that is to say where summer is simultaneous with our winter. This adjustment has been kept in mind, and at the present time it is possible to present preliminary data on a yet unsettled adaptation.

The species in point is *Melitara junctolineella* Hulst,[1] an insect indigenous to North America. The larvae feed within the thick joints

[1]Order *Lepidoptera*, Family *Pyralidae*.

of the western prickly-pears, causing large swellings. When full-grown they leave the joints and spin their cocoons beneath fallen segments or other rubbish near the base of the prickly-pear plant. The large sluggish moths which issue from the cocoons mate quickly, deposit eggs as "sticks" and soon die.

During May and June, 1921, stocks of larvae were collected in the vicinity of Uvalde, Texas. The progeny of these insects are still on hand partly in Australia and partly in Texas. Of course, moths emerging from later collected material were mingled with the original lot, but this fact does not affect the developments to be pointed out.

Below is shown the record of the generations of this material from May, 1921 to May, 1923.

RECORD OF GENERATIONS

Year	Month	At Uvalde, Texas, U. S. A.	At Brisbane, Australia.
	May	Emergence	
		Oviposition	
	June		
	July	Larval	On Dec. 6, 1921 a portion of the insects left the U. S. A.
	Aug.	Larval	and arrived Brisbane, Aus-
1921		Pupation	tralia on Dec. 30, 1921.
	Sept.	Emergence	Further happenings to this
		Oviposition	portion are shown below.
	Oct.		
	Nov.	Larval	
	Dec.	Larval	Pupated en route
	Jan.	Larval	Emergence
			Oviposition
	Feb.	Larval	Larval
	Mar.	Larval	Larval
	Apr.	Pupation	Pupation
	May	Emergence	Emergence
		Oviposition	Oviposition
	June		Larval
1922			
	July	Larval	Larval
	Aug.	Larval	Larval
		Pupation	
	Sept.	Emergence	Larval
	Oct.	Oviposition	Larval
			Pupation
	Nov.	Larval	Emergence
			Oviposition
	Dec.	Larval	Larval
	Jan.	Larval	Larval
	Feb.	Larval	Larval
1923	Mar.	Larval	Pupation beginning
	Apr.	Pupation	Emergence & oviposition beginning.
		Emergence	
	May	Oviposition	Pupation ending

From the above record of the seasonal history of the species, it will be noted that at Uvalde there are two generations annually. The over-

wintering larvae emerge from late April to early July, reaching the maximum emergence during May or June depending upon the weather conditions. The summer brood develops in a relatively short period and the fall appearance of adults occurs from late August to early November, usually attaining the peak of emergence about the first of October. The progeny of these fall moths pass the winter in the larval condition. Thus, the summer generation requires four months from egg to adult, while the winter brood takes eight months.

Now, a portion of this material was packed with cactus in properly lighted and ventilated cases and shipped via San Francisco, Honolulu, Pago Pago and Sydney to Brisbane, Queensland. The shipment left San Francisco on December 6, 1921 and reached Brisbane at the end of that month. Enroute the cases were placed on the bridge deck of the S. S. Sonoma beneath a canvas canopy which was removed in the early morning each day to allow the sunlight to enter the cases.

The larvae were just one month from the egg on the date of departure from San Francisco. They were of the winter brood which would normally spend about six months in the larval stage.

This shipment of material was opened in the laboratory at Sherwood (near Brisbane), Queensland on January 5, 1922. Practically all of the larvae were found to have pupated enroute, and on January 7, 1922 the first adults issued from the cocoons. Emergence ended on February 1, 1922. Thus, the passage through and into summer weather in the tropics and in the Southern Hemisphere greatly accelerated the development of these winter brood larvae.

It will be noticed, then, that the (now) Australian portion emerged and oviposited in January, 1922, fully five months prior to the emergence and oviposition dates recorded for that portion of material which remained in the native habitat of the species.

Again, the progeny of this first Australian generation completed another cycle about May 18, 1922. Thus, two generations of the Australian material completed their cycles slightly before the normal spring emergence at Uvalde of the portion which remained at home.

The third generation of the Australian portion began about the proper time for the larvae to get started just before the advent of the winter season in Southern Queensland. The emergence of adults of this brood was rather drawn out, probably having been influenced by the upsetting of the normal development of the two previous generations. The adults issued from October 31, 1922 to January 2, 1923.

The fourth generation of the Australian lot numbered several thousand, and emergence of the adults began on April 13, 1923. On May 18, 1923 pupation of this brood was practically completed, so it may be judged that the maximum emergence period would be about the middle of May, 1923.

The fifth generation of the Australian batch may, then, be considered to date from May 15, 1923.

Thus, during the period when the species was accomplishing its swing-over from the seasons of the Northern Hemisphere to those of the Southern Hemisphere, there were produced three generations in sixteen months.

The rapidity of development of the species during midsummer (January-February) in 1923 is shown by the notes on certain cages of the fourth generation material. These cages received freshly deposited eggs about the first of January, 1923 and the adults issued therefrom within three months.

From the reactions to the Australian seasons so far observed it seems that in the ultimate adjustment to seasons, *Melitara junctolineella* will have three generations annually instead of the two which occur in Southwest Texas.

The manner in which such adjustment will be worked out may be seen in the transition period above reviewed. Those portions of a given brood which appear at unfavorable intervals are eliminated, and only that part of the brood which happens to appear at the opportune time will be preserved. Such elimination and preservation should, after a number of generations, accomplish a thorough adjustment of the brood cycle to the seasonal cycle in the new environment.

The observed rapidity of development and the long summer of Queensland strongly indicate that the final adaptation of this species to that environment will be three broods yearly.

The over-wintering generation will probably emerge about the middle of October and complete its cycle in three and one-half months. About the end of January, then, the second brood would begin, and the adults of this generation emerge about the middle of May. The progeny resulting from the May moths would pass the winter as larvae in approximately five months.

A further note of interest regarding this North American plant-feeding insect in Australia is that the adults are noticeably larger on the latter continent.

TOBACCO DUST AS A CONTACT INSECTICIDE[1]

By P. J. PARROTT and G. F. MACLEOD,

New York Agricultural Experiment Station, Geneva, N. Y.

ABSTRACT

From the data secured during experimental work reported on the following pages, it is concluded that the finer grades of tobacco dust, containing 1 percent nicotine, are highly toxic to the spirea aphis (*Myzus persicæ*). Observations of the spirea plantings under treatment during the past two seasons also indicate that timely applications of fine tobacco dust would afford adequate protection. In comparison with superfine tobacco, dust mixtures containing free nicotine or nicotine sulfate were, on an average, somewhat more effective but the actual difference in toxicity was not marked.

As the tests were made in greenhouses it is not safe to conclude that finely powdered tobacco would prove equally effective against the same insect under normal field conditions. The insecticidal properties, however, are such as to suggest the desirability of more knowledge of the value and economy of the material in combating other noxious species.

In conclusion it should be noted that commercial grades of tobacco show a lack of standardization since they vary greatly in nicotine content and physical properties. Considering the nicotine content of tobacco dust and commercial brands of tobacco extracts in relation to prices, powdered tobacco is apparently more expensive than the commercial solutions.

In considering the merits of dusting as related to orchard management in New York, there is need of experimental data regarding the value of dust mixtures in combating such insects as the green apple aphis, rosy aphis, leafhoppers, redbugs, pear psylla etc. To combat insects of this character there is not a wide range of available substances with desirable insecticidal properties. At present nicotine sulfate is widely used and recently free nicotine has been recommended for the control of certain species. These are certainly the most effective constituents of dust mixtures which function as contact insecticides, but a serious drawback to their extensive employment is their high cost. The situation reveals the desirability of more knowledge concerning the toxic properties of other substances.

Of the materials considered deserving of more serious consideration than has apparently been devoted to it is tobacco dust, and during the past two years the Geneva Experiment Station began a serious investigation to determine its value in combating the common sucking insects of orchard and farm crops. This paper deals largely with the more important results of tests with tobacco dust against the aphis (*Myzus persicæ* Sulz.) on spirea (*Caryopteris mastacanthus*), a plant which is grown extensively in greenhouses of local nurseries.

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[1]Presented at the Meeting of the Division of Agricultural and Food Chemistry of the American Chemical Society at New Haven, Connecticut, April 4, 1923.

The Nicotine Content and Physical Properties of Tobacco Dust

In the Virginia Station Bulletin 208, Ellett and Grisson state "that the nicotine content of tobacco varies greatly, depending upon many factors. The fertility of the soil and the kind of soil both have influence. In curing, the temperature is often allowed to run too high and nicotine is lost by volatilization. To ascertain the amount of nicotine, chemical analysis is required." The nicotine content of Virginia tobacco is as follows: Stems, 0.48 to 0.60 percent; sweepings, 0.73 to 0.88 percent; N. L. Orinoco, 5.35 to 5.62 percent; olive, 3.63 percent; light, 2.9 percent; smoker, 2.30 percent; wrapper, 3.05 percent; cutter, 3.46 percent; dark, 2.83 percent; medium smoker, 3.76 percent; and common smoker 2.47 percent. "Stems had less nicotine content than leaves and dark varieties of tobacco, as Narrow-Leaf Orinoco and Burley, had higher ratios of nicotine than bright or flue-cured types."

There is, apparently no standard for tobacco dust either with respect to nicotine content or physical condition. In comparison with the foregoing figures, it is interesting to note that analysis of various lots of tobacco dust purchased in the State of New York showed considerable variation in nicotine, as follows: Sample 1, 0.88 percent nicotine; Sample 2, 0.58 percent; Sample 3, 0.50 percent; Sample 4, 0.95 percent; Sample 5, 0.98 percent; and Sample 6, 1.00 percent.

A few grades of tobacco dust purchased during the past summer were quite fine, but the larger number of samples contained a considerable amount of coarse material. Most preparations consisted of fine and coarse particles in varying proportions. A common constituent of tobacco was clay or dirt or other cheap adulterant substance or filler.

In our experiments we used a tobacco dust which was guaranteed to contain 1 percent nicotine. The physical properties of this tobacco dust were as follows: Less than 50-mesh screen, 18 percent; 50-mesh, 27 percent; 100-mesh, 1 percent; 150-mesh, 10 percent; and 200-mesh, 44 percent.

To obtain larger amounts than were available of the more finely pulverized material, the tobacco dust was ground for six hours or more in a ball machine. This is not an entirely satisfactory outfit for the purpose because of the large amount of time required for grinding and its failure to pulverize completely all the coarse particles. Regrinding, even with this machine, did improve greatly the physical properties of common grades of tobacco dust. This is shown by comparing the foregoing figures relative to untreated tobacco dust with the accompanying analysis of a sample which was subjected to grinding for several hours:—

Less than 50-mesh, 1 percent; 50-mesh, 11 percent; 100-mesh, 2 percent; 150-mesh, 12 percent; and 200-mesh, 74.5 percent. Supplies of tobacco dust of different degrees of fineness were obtained by passing the reground material thru screens of designated sizes.

Toxicity of Coarse and Fine Tobacco Dusts

In this series of tests commercial tobacco dust and reground tobacco of different degrees of fineness was applied at the rate of 5 grams to each spirea, the material being applied carefully in order to insure thoro treatment. Sheets were attached firmly to the collar of each plant and "tanglefoot" was applied to the edges of the sheets to prevent the insects from escaping. Twenty-four hours after treatment the number of dead and live insects were counted. With the exception of the coarser grades of tobacco dust all or a majority of the insects were usually dislodged by the applications, and there is little doubt that the plants received greater protection than is indicated by the recorded killing efficiencies. The data are presented in Table 1.

A study of the foregoing data shows plainly that the finer grades of tobacco dust possessed greater killing powers than the coarse preparations. The 200-mesh material obtained from the reground tobacco was superior to other grades in its toxicity to the aphids and in its physical condition. Tobacco dusts of 50-mesh fineness or coarser displayed low killing power and poor adhesive properties.

Effects of Hydrated Lime on the Physical and Insecticidal Properties of Tobacco Dust

Chemical analyses demonstrated that hydrated lime in combination with tobacco dust promoted the liberation of nicotine. Observations also indicated that the incorporation of light fluffy material such as lime hydrate of 200-mesh fineness improved the physical condition of tobacco dust. To determine the influence of these factors a series of tests were undertaken, the results of which are indicated in Table II.

It will be observed that in general the mixing of hydrated lime with tobacco dust resulted in decreased toxicity, and that the loss of insecticidal efficiency increased proportionately with the amount of lime added. Mixtures containing 10 percent lime hydrate were not as effective as undiluted tobacco dust but they were more toxic than those containing 25 percent hydrated lime. On the other hand the physical properties of tobacco dust, especially the coarser grades, were considerably enhanced by the addition of lime hydrate. Altho lime tends to liberate nicotine, its failure to affect appreciably the insecticidal properties of the mixtures

TABLE I.—EFFECT OF FINE AND COARSE TOBACCO DUST ON *Myzus persicæ*

Grade of Material	Experiment No. 1		Experiment No. 2		Experiment No. 3		Experiment No. 4		Experiment No. 5		Experiment No. 6		Experiment No. 7		Total No. of insects	Average Perc't killed
	Total No. of insects	Perc't killed	Total No. of insects	Perc't killed	Total No. of insects	Perc't killed	Total No. of insects	Perc't killed	Total No. of insects	Perc't killed	Total No. of insects	Perc't killed	Total No. of insects	Perc't killed		
Tobacco Dust																
50 mesh mixture	310	27	303	10	320	20	411	14	287	21	342	18			2033	18.3
100 mesh mixture	213	80	367	76	245	77	406	75	345	71	435	74			2006	75.5
150 mesh mixture	312	72	361	70	314	65	487	55	270	68	351	70			2095	66.6
200 mesh mixture	303	71	308	62	312	61	423	52	214	55	354	65			1914	61.0
Reground Tobacco Dust																
50 mesh mixture	295	22	227	36	305	10	420	07	280	06	272	02	422	04	2221	12.4
100 mesh mixture	236	77	256	72	212	65	391	74	386	67	225	70	330	68	2036	70.4
150 mesh mixture	309	70	354	72	429	74	214	87	306	77	277	74	330	76	2219	75.7
200 mesh mixture	339	90	529	94	377	92	260	92	377	95	294	89	415	88	2591	91.4
															Grand Total No. of insects:— 17115	

TABLE II.—EFFECT OF ADDITION OF HYDRATED LIME TO TOBACCO DUST

Grade of Material	Experiment No. 1		Experiment No. 2		Experiment No. 3		Experiment No. 4		Experiment No. 5		Experiment No. 6		Experiment No. 7		Total No. of insects	Average Perc't killed
	Total No. of insects	Percent killed	Total No. of insects	Percent killed	Total No. of insects	Percent killed	Total No. of insects	Perc't killed	Total No. of insects	Perc't killed	Total No. of insects	Perc't killed	Total No. of insects	Perc't killed		
Tobacco dust with 10% Lime Hydrate	451	96.5	219	93.6	382	90.3	484	89.2	244	86.9	299	90.1	295	91.0	2374	91.1
Tobacco Dust with 25% Lime Hydrate	249	84.6	301	83.1	380	92.2	202	86.1	308	85.7	332	86.6	335	87.0	2107	86.5
Tobacco Dust with 50% Lime Hydrate	329	83.4	393	93.3	272	82.4	328	74.9	376	82.8	357	76.2	275	77.4	2330	81.5
Tobacco Dust	292	95.8	285	98.6	251	92.6	240	96.7	270	92.6	313	93.7	312	96.4	2063	95.2
100 mesh Tobacco	203	60.1	321	78.2	201	82.1	114	74.6	621	75.2	241	81.2	301	71.7	2002	74.7
100 mesh Tobacco and Lime 10%	254	41.6	308	46.1	193	62.4	369	42.6	421	39.9	381	44.7	262	42.1	2188	45.7
150 mesh Tobacco	675	98.4	247	75.7	199	91.5	301	87.7	247	90.2	381	89.5	287	90.1	2337	89.0
150 mesh Tobacco and Lime 10%	237	76.5	222	79.5	210	86.3	373	77.5	287	79.8	341	81.8	369	80.4	2039	78.9
200 mesh Tobacco	380	98.9	434	96.8	373	97.9	214	98.1	320	95.1	294	93.5	259	97.6	2274	96.8
200 mesh Tobacco and Lime 10%	260	97.3	252	94.6	336	96.7	298	94.2	426	95.2	238	92.1	244	93.7	2054	94.8
															Total No. of insects:—21768	

TABLE III.—RELATIVE TOXICITY OF 1 PERCENT TOBACCO AND NICOTINE DUST ON M. PERSICÆ

Material	Experiment No. 1		Experiment No. 2		Experiment No. 3		Experiment No. 4		Experiment No. 5		Experiment No. 6		Experiment No. 7		Total No. of insects	Average Percent killed
	Total No. of insects	Percent killed	Total No. of insects	Percent killed	Total No. of insects	Percent killed	Total No. ins'ts	Percent killed	Total No. of insects	Percent killed	Total No. of insects	Percent killed	Total No. of insects	Perc't killed		
200 mesh Reground Tobacco Dust 1% Nicotine	343	98.9	378	97.2	264	96.6	227	97.5	314	95.5	321	94.1	286	96.7	2133	96.6
Lime Carbonate with 1% Nicotine	299	99.0	271	98.6	302	99.1	268	100.0	274	98.4	382	100.0	287	99.3	2083	99.2
Lime Hydrate with 1% Nicotine	244	94.9	215	99.2	379	99.1	214	100.0	323	99.6	216	100.0	270	99.4	1861	98.8
Sulfur with 1% Nicotine	362	93.0	254	89.9	326	99.2	260	100.0	305	95.5	251	99.7	373	99.6	2131	97.7
Kaolin with 1% Nicotine	252	77.1	277	79.2	340	80.1	267	76.4	229	85.3	339	74.9	485	76.1	2189	78.4
Lime Carbonate with 1% free Nicotine	550	97.1	484	99.8	591	98.1	602	98.9	332	99.1	213	98.7	290	99.7	3062	98.8
Lime Hydrate with 1% free Nicotine	449	97.2	513	98.1	366	94.5	741	98.5	305	99.7	339	98.6	181	96.2	2894	97.5
Sulfur with 1% free Nicotine	314	100.0	482	94.2	245	98.8	508	97.8	228	100.0	326	99.7	203	100.0	2306	98.6
Kaolin with 1% free Nicotine	240	72.5	398	84.2	222	73.8	284	77.5	224	71.5	236	74.6	234	72.6	1838	75.2
															Total No. of insects — 20497	

TABLE IV.—TOXIC ACTION OF TOBACCO AND NICOTINE PREPARATIONS TO M. PERSICAE

Material Used	Method of Application	Time required To Act minutes	Total No. of insects	Percentage killed
200 mesh tobacco dust	In contact with insects	3.00	426	95.7
200 mesh tobacco dust	Not in contact with insects	15.00	587	100.0
200 mesh tobacco dust with 25% hydrated lime	In contact with insects	2.75	645	92.9
200 mesh tobacco dust with 25% hydrated lime	Not in contact with insects	7.50	472	100.0
Hydrated lime with 1% nicotine	In contact with insects	0.50	451	97.8
Hydrated lime with 1% nicotine	Not in contact with insects	1.00	437	100.0
Check—No treatment	Not in air-tight jar	——	554	00.8
Check—No treatment	In air-tight jar	——	608	00.0

tested may perhaps be explained on the supposition that the evolution of nicotine was slow.

Relative Efficiency of Tobacco, Free Nicotine and Nicotine Sulphate Dusts

This series of tests were designed to show the comparative insecticidal properties of dust mixtures, containing respectively fine tobacco dust, free nicotine and nicotine sulphate. The different preparations contained approximately 1 percent nicotine and were applied at the rate of 5 grams per plant. The results obtained with the dusts are indicated in Table III.

On the whole, tobacco dust did not exhibit as high a rate of toxicity as did the mixtures containing free nicotine or nicotine sulfate, but the difference in insecticidal properties was, however, not very conspicuous. The free nicotine dusts were more rapid in their paralytic action than those containing nicotine sulfate, and tobacco dust was the least rapid in dislodging the insects. The mixtures in which kaolin was incorporated as a carrier of free nicotine or nicotine sulfate displayed a killing efficiency of less than 80 percent, while the preparations using sulfur and lime carbonate or hydrate as carriers of the nicotine were noticeably more efficient.

Toxicity of the Fumes of Dusting Mixtures

To obtain data relative to the toxicity of the fumes given off by the different nicotine dusts, applications of the materials were made to the walls of large bell jars, after which the jars were placed over plants heavily infested with aphids. In making these experiments care was exercised to prevent any of the particles of the various materials from coming in contact with the bodies of the insects. For the sake of comparison several plants were dusted with the same preparations. The data are given in Table IV.

The insects confined in the dusted bell jars exhibited no apparent signs of unrest, while those on the treated plants began to move immediately after the application and seemed agitated. The aphids began to fall from the dusted plants in half the time required to dislodge those subjected only to the fumes arising from the walls of the jars. Notwithstanding the greater speed with which the dusts in contact with the insects acted the final killing was more complete in the case of the enclosed plants. These insects were killed *in situ* and were usually attached to the leaves by the proboscis which had not been extricated at the time of paralysis. It is also interesting to note that only a very few

insects were dislodged from these plants while a larger percentage of the insects fell from the dusted spireas.

THE CONSTITUTION OF OIL EMULSIONS

By E. L. GRIFFIN, *Associate Chemist, Insecticide & Fungicide Laboratory, Miscellaneous Division, Bureau of Chemistry, Washington, D. C.*

ABSTRACT

In an emulsion of mineral oil with soap and water the mineral oil is divided into very small droplets which are suspended in the watery medium. The soap is added to keep these droplets from coalescing and finally separating out. Its action is as follows: part of it is broken down, the fatty acids being dissolved in the kerosene and the alkali remaining in the water; part of it forms a film between the oil and the water, preventing the droplets from coalescing, thus stabilizing the emulsion; and any excess soap remains in water solution and helps the spreading qualities of the spray.

The breaking down of the soap may be prevented, or at least made negligible, by the addition of excess alkali, thus preventing an apparent waste of soap.

Two emulsions of the type used in practice were analyzed and the distribution of the soap in them reported.

The oil emulsions used as insecticides consist of very small droplets of oil suspended in watery media. An emulsion can be formed of oil and water only, but it is unstable and the components soon separate. A stabilizer, usually a soluble soap, is added to overcome this tendency. In the past there has been little or no definite knowledge as to what happens to the soap in the emulsion and just what part it plays in the process of emulsification. There was, therefore, nothing to guide in the preparation of an emulsion except previous experience as to what produced a satisfactory product. When difficulties occurred, and they were not infrequent, there was often no good explanation for them or guide to prevent them in the future.

In a recent paper[1] the fate of the soap in the process of emulsification is shown to be as follows and in the order given.

1. Part of the soap is broken down (hydrolyzed) into the alkali and fatty acid from which it was originally formed and the fatty acid goes into solution in the oil, leaving the alkali in the water.
2. Part forms a layer or film of uniform thickness around the droplets of oil.
3. All of the soap not used in 1 and 2 remains in the water solution.

HYDROLYZED SOAP

Soaps in dilute water solution partially hydrolyze, or break down, into the alkalies and fatty acids from which they were originally made. The

[1]Griffin, J. Am. Chem. Soc., 45:1648 (1923).

fatty acids are very soluble in mineral oils and so are taken up by the oil droplets. This leaves the alkali in the water. The process of hydrolysis goes on until the concentration of the alkali is so great that the tendency to hold the fatty acids in the water in the form of soap is as great as their tendency to go into solution in the oil.

The soap which is thus broken down does not appear to serve any useful purpose and is apparently a total loss. It has been shown experimentally that this loss may be prevented by adding enough alkali to keep the soap from hydrolyzing and freeing fatty acid which would go into solution in the oil. This is in agreement with the work of Briggs and Schmidt[2] who found that small quantities of alkali tended to assist in the formation of emulsions of benzene in soap solution. The fish-oil soap, which is recommended by the Bureau of Entomology for use in making oil emulsions,[3] contains a considerable excess of alkali and is particularly suited to the preparation of oil emulsions. Of course, in the addition of alkali the possibility of injury to vegetation by excessive quantities of it must be borne in mind.

Films Surrounding the Droplets of Oil

If an oil is broken into droplets in water, the droplets readily coalesce and the oil separates out. However, if a soluble soap is present in the water, soap immediately attaches itself to the oil droplets to form films around them. This film prevents the droplets of oil from coalescing and is the essential feature in stabilizing emulsions of this type. It is exceedingly thin; in fact, its thickness is the length of a single molecule of the soap and is the same whether the soap solution from which the film is formed is dilute or concentrated. The quantity of soap necessary to form it is comparatively small. One gram of soap will cover an area of 500 to 1000 square meters, depending on the kind of soap. One very good commercial emulsion contained 66% of oil and had droplets which averaged about 0.0003 centimeters in diameter. These have an area of 2 square meters for each cubic centimeter of oil dispersed. One gram of soap would therefore form the film necessary for from 375 to 750 cubic centimeters of this emulsion. With coarser emulsions (larger oil droplets) less soap is needed. Thus, if the emulsion is 66% oil and has droplets averaging 0.001 centimeter in diameter, 1 gram of the soaps would be used to form the film for 1,250 to 2,500 cubic centimeters of the emulsion.

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[2] Briggs and Schmidt, J. Physical Chem., 19:478–99 (1915)
[3] Quaintance and Siegler, Farmers' Bulletin 908, U. S. D. A. (1918).

If not enough soap, in addition to that broken down to fatty acids and alkali, to form the films for the droplets is present, the emulsion will not be permanent. There will be nothing to prevent the droplets from coalescing and the oil will therefore separate out. There need not, however, be a large excess of soap. It is possible to utilize nearly all of the soap from a solution for the formation of film.

Soap Remaining in Solution

The excess soap remaining in solution in the water is of no value in so far as stabilizing the emulsion is concerned. In the application of sprays, however, their wetting and spreading qualities are of very great importance. Soapy water wets foliage and spreads on it much better than water without soap. This is connected with the lowering of surface tension caused by the addition of soap to water. The surface tension of water is very much lowered by the addition of small quantities of soap. Larger quantities do not affect it proportionately. There is probably, therefore, an optimum concentration of excess soap which may be used in the emulsion. This quantity must be determined by experiment.

Experimental Emulsions

To illustrate the partition of the soap in practice, a kerosene emulsion made by the method of Quaintance and Siegler,[4] using commercial neutral sodium fish-oil soap, was analyzed. It contained 1.80% of dry soap. This was distributed in the emulsion as follows: 8% of the soap was lost by hydrolysis and solution in the kerosene; 12% was used in the formation of films to keep the droplets of oil from coalescing; and 80% remained in the water solution.

Another emulsion was made in the same manner, except that a small quantity of sodium hydroxide (about 30 cc. of normal solution per liter) was added to the soap solution. In this case the droplets were slightly larger than in the first emulsion owing probably to variation in the agitation. None of the soap was hydrolyzed. About 9% was used in the formation of films, and the other 91% remained in the water solution.

DELAYED EMERGENCE OF HESSIAN FLY FOR THE FALL OF 1922

By W. B. Cartwright,
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Abstract

A delayed emergence of Hessian fly occurred within a triangular area bounded by the Mississippi and Ohio Rivers and a line drawn eastward from St. Louis. Ab-

[4] loc. cit. p. 28.

normal conditions of temperature and rainfall were the primary causes of this delayed emergence. Normal emergence consisted of two small waves on September 22 and 30 respectively, from which progeny developed normally. The heavy delayed emergence occurred October 27 to 30 from which progeny struggled through the winter with at least a 25% death rate. Infestation by progeny of the late emergence caused total loss of 24% to 38% of wheat plants sowed on the usual recommended dates and some injury to an additional 24% to 37%.

The emergence of the Hessian fly (*Phytophaga destructor* Say) wherever it occurred throughout the East Central States in the spring of 1922 was normal. The fall emergence for this territory occurred as partially regular and in certain areas markedly irregular. This irregular or delayed emergence was centered within the triangular area bounded roughly by the Mississippi and Ohio Rivers and a line drawn eastward from St. Louis, Missouri. It is intended to review the climatological conditions existing from the time of the regular spring emergence to the delayed fall emergence and to discuss the behavior and economic aspect of the latter.

Climatological data of the U. S. Weather Bureau for Illinois and Indiana, the states invaded by the irregular fly brood, show that for July the average temperature was almost normal. For August in Illinois the state average of temperature was not unusual but precipitation was the least since 1897, the deficiency being as much as three inches in places. In Indiana the mean August temperature was slightly above normal and precipitation deficient. September in Illinois was warm and dry with more clear weather than any year since 1897. Deficiency in rainfall ranged from one to four inches south of the Illinois River with practically no rainfall after the 20th. Temperature in Indiana for September was above normal and precipitation deficient and with minor exceptions practically no rainfall after the 20th. For both Illinois and Indiana October opened with high temperature. For Illinois temperature was 10 to 14 degrees above normal from the first to 6th, 10 degrees below normal from the 12th to 17th, and 12 to 18 degrees above from 27th to 31st. For Indiana the second decade was colder and killing frosts occurred in nearly all counties on the 13th, followed by recurrences on the 18th to 20th. The last week was much above normal. Rainfall for both Illinois and Indiana occurred within periods 6th to 11th, 13th to 16th, and 22nd to 23rd and none for the remainder of the month.

The activity of the Hessian fly was continuously observed at Centralia, Illinois and the following data compiled from the records of this place. Drouth was temporarily broken by rainfall on September 10th and 19th, a total of .6 inch. Almost coincident with this period of moisture, adult Hessian flies appeared September 22nd and represented the first wave of

the normal fly emergence. On September 30th another small wave of flies appeared. The source of these individuals was not determined and oviposition was so light that less than 3% infestation resulted in wheat of volunteer status. Pupariation of the progeny of the first wave began October 18th and was completed October 28th, pupariation of the progeny of the second wave began November 6th and was completed November 17th. Thus ended the normal activity of the fly for the fall.

On the night of October 6th a heavy rainfall supplied all fields with excess moisture. An apparent complete transformation of fly larvae was noted October 16th. Adults issued October 27th to 30th and oviposition was heavy. Over half the progeny entered the winter as small larvae. Pupariation began near the middle of January and ceased in general March 1st though naked larvae were found occasionally to April 1st. Pupariation was not completed as death rate ran high through March and ended the tragic struggle. From records made in December and February a 25% death rate was computed for this interval. After this time no definite figures were obtainable, due to the disintegration of infested wheat plants. Concrete data obtained February 23rd showed a 70% pupariation as a whole for the progeny in early sowed wheat. Closer analysis revealed a greater pupariation of not less than 75% for forms existing in growing plants with less than 50% pupariation in dead plants. In wheat representing the general fall seeding a 45% pupariation existed, with dead plants revealing a range of 38 to 54 in percentage of pupariation. On April 4th dead plants which had been infested showed 26% without fly life. Reversion of larvae in the flaxseeds began March 31st and ended near April 12th. Pupariation occurred from April 16th to 29th and adults emerged April 22nd to May 8th

Mr. W. H. Larrimer of the Bureau of Entomology, noted that a transformation of the Hessian fly did not occur in stubble in the central and northern areas of Indiana during October but that practically all of the larvae remained as "hang-overs" in the stubble. To what extent the killing frosts and low temperatures influenced the behavior of the fly remains questionable. A few irregular flies were recorded by other workers of the Bureau of Entomology at points in the wheat area east of the Mississippi River during the heavy emergence at Centralia, Illinois, but in numbers of no consequence. South of the Ohio River the activity of the fly merged into normalcy of the southern area.

The economic aspect of so heavy delayed emergence is important. The droughty condition of August, September, and early October interfered greatly with fall preparation of wheat land. Seed beds which

were prepared and seeded to wheat remained dust-like until the periodic rains of October. Germination of early seeded wheat was irregular and incomplete until after the rains. Too much moisture immediately after the rains delayed sowings. Hence from the general weather conditions most of the wheat did not appear above ground until two weeks after the recommended dates to evade Hessian fly attacks. It was therefore, in an attractive stage for fly oviposition and in the stage in which plants would greatly suffer from fly injury. There was a three-fold struggle through the winter, a struggle of host and enemy, the death of one meant the death or life of the other, and the composite struggle of both to survive the winter coldness. From 24% to 38% of the wheat plants sowed to one week after the recommended dates died. An additional 24% to 37% of plants on good land and land properly prepared and seeded evaded death by the rapid growth of secondary culms. Late sowed wheat lacked heavy infestation of the fly in the fall and missed winter kill.

RESULTS OF AN OIL SPRAY IN TREATMENT OF BOX LEAF MINER (*MONARTHROPALPUS BUXI*) LABOU.

By JAS. K. PRIMM, and E. A. HARTLEY, *Bureau of Plant Industry, Harrisburg, Pennsylvania.*

ABSTRACT

The box leaf miner, *Monarthropalpus buxi* (Diptera, Itonididæ) injuries has resulted in a reduced demand for certain varieties of boxwood. A series of experiments indicate limited usefulness for the molasses spray and very satisfactory results were obtained with a heavy emulsifying petroleum oil, 1–20, and a pint of Black Leaf 40 to 50 gallons of spray, making one or two applications.

A decrease in the demand for certain varieties of boxwood, especially *Buxus sempervirens*, is noted among nurserymen in the eastern part of Pennsylvania and is attributed to the unfortunate experiences which people have had with the box leaf miner (*Monarthropalpus buxi*). The encouraging results obtained by the use of sticky applications to the foliage, designed to entrap the adults at the time of emergence and prevent oviposition, have been largely offset by the cost of material and the multiplicity of failures due to heavy rains during the emergence period which washed off the sticky coating, and entailed a second, or sometimes a third outlay for spray material with a lessened prospect of control.

On estates where a noticeable reduction of infestation has been attained by the most generous use of labor and material, how much credit should go to the molasses treatment and how much to other methods

which are used to supplement this treatment is a matter of conjecture. There is evidence, however, that most of these treatments may just as well be discarded as applied by the average owner of boxwood, laboring under the popular misconception that because it worked for Mr. Smith under one set of conditions it should work for Mr. Brown under an entirely different set. There is no doubt that control could be secured whether the material used is molasses, rosin fish oil soap, tobacco extracts, or any other efficient contact spray, if the time and frequency of applications is properly correlated with the emergence period and the varying weather conditions.

In southeastern Pennsylvania adults have been observed emerging as early as April 17th on imported stock from Holland which had just been unpacked from crates and which doubtless had been kept at a warm temperature in transit. In 1921, emergence under natural conditions was first noted on May 1st, and in 1922 pupation was first noted on April 18th and emergence on May 8th. The period of emergence seems to be regulated by seasonal temperatures, and doubtless must be preceded by a settled temperature of 70° to 80° F. for a period of two or three weeks. In the spring of 1920, which was late, the first emergence was noted by Hamilton[1] in the vicinity of Baltimore, on May 19th.

Recent success with fumigation suggests this treatment as the most certain of accomplishing results, but the expense, as well as danger, incident to fumigation with hydrocyanic gas, and the limited period—when the insect is in the pupal state—in which it has been found to be effective will not warrant its use except in the case of very valuable specimen plants. The elements which are lacking in making the molasses treatment of more general value, cheapness and greater resistance to rain, are thought to be found, in the experience of the writers, in the use of a heavy emulsifying petroleum oil. Its capacity for entangling the adults and checking oviposition is fully as efficient as in the molasses treatment, as indicated from the results of our field experiments in the spring of 1922. The product used is manufactured by the Sun Oil Company, and is free from any animal or vegetable fats. It has a Baumé registry of 16 to 17 degrees and viscosity of 1200 at 70° F.

The outcome of a number of preliminary experiments with various materials to ascertain their effect on the foliage of boxwood with a view to killing the larvae in the leaves or of causing the foliage to drop, was negative, but it was in the incidental use of this oil as a spreader for "Black Leaf 40" that its extremely viscous and adhesive properties were

[1]Jour. Econ. Ent., Vol. 14, No. 4, August 1921, pp. 359-365.

first demonstrated. A few plants were then sprayed with one part of oil diluted with twenty of water and were left for observation. Little foliage injury followed and when thoroughly dried there was left a heavy oily blanket which was evenly distributed over both the old and new growth and which did not wash off in a heavy rain.

Because of the large number of heavily infested boxwood on one of the private estates near Philadelphia, the cooperation of the superintendent was obtained and a long section of hedge of *Buxus sempervirens* was reserved for treatment with this oil. Preparations were made to spray the bulk of the boxwood with resin fish oil soap (ten pounds to fifty gallons) and "Nikoteen" (one pint to fifty gallons of the soap solution). A large nursery also adopted this treatment, using "Black Leaf 40" instead of the "Nikoteen." It was discontinued by both parties after a few applications and the remaining sprays consisted entirely of the oil solution. A neighboring estate proposed to spray its boxwood with a good grade of "black jack" molasses (one part to three of water) and "Black Leaf 40" (one part to 264 of the molasses mixture). A commercial firm undertook the fumigation of about fifty fine specimen box on the latter estate with a guarantee of its success. The first applications of spray were given on May 9th, the day after the emergence of the first adults. In all of the oil applications (1-20), "Black Leaf 40" was used (one part to 500 of the spray).

Counts were made the first three days after the applications of the spray to determine the comparative number of adults which had emerged successfully, with the number found trapped in the spray and the number of extruded pupae which failed to emerge successfully. Similar counts were taken from twigs of bushes sprayed with the resin fish oil soap and the molasses mixtures. The final percentages of control are based upon counts made the following July of the number of eggs successfully hatched, as it was found a large percentage of the eggs which were deposited in both the treated and check plants were either infertile, or else did not develop from other causes which were not ascertained. The checks in each case were untreated plants of a similar degree of infestation as the plants which were treated. The oil spray was applied by the writers with a small compressed air sprayer; the molasses and resin fish oil soap sprays were applied by workmen on the estates with a barrel pump outfit.

OIL APPLICATIONS

Exp. 1. Sprayed *May 9th* with "Sun Miscible Oil" (1–20) and "Black Leaf 40" (1–500).

Exp. 2. Sprayed *May 9th* & *May 11th* with "Sun Miscible Oil" (1-20) and "Black Leaf 40" (1-500).

Exp. 3. Sprayed *May 9th* with "Sun Miscible Oil" (1-20) and "Black Leaf 40" (1-500), and on *May 12th* with "Black Leaf 40" only, (1-500).

Exp. 4. Sprayed *May 9th* & *May 12th* with "Sun Miscible Oil" (1-20) and "Black Leaf 40" (1-500) and again on *May 20th*, with the same, following a heavy two-day rain on May 17th and 18th.

Exp. 5. Sprayed *three times* as in Exp. 4. The preceding experiments were confined to sections of the hedge, the latter to a heavily infested isolated bush, much taller and with more open foliage than in the case of the hedge.

RESIN FISH OIL SOAP, MOLASSES AND GAS TREATMENTS

A. Sprayed with resin fish oil soap (10 lbs. to 50 gallons) and "Nikoteen" (one pint to 50 gallons of soap solution) on *May 9th* & *10th*.

B. Sprayed with molasses (1-3) and "Black Leaf 40" (1-264) on *May 11th*. No adults emerged on this bush until May 10th.

C. *One application* as in B., and *two succeeding ones* following rains on May 17th & 18th which washed off those preceding.

D. Fumigated by commercial firm with hydrocyanic gas *May 6th* & *7th*, three hours exposure each time. Dosage not known. Many miners still in larval stage.

E. Fumigated as in D once only, on *May 10th*. Three hours exposure. Dosage not known. Most of miners in the pupal stage.

The following tabulation shows the counts made to determine the relative number of adults successfully emerged, adults trapped in the spray, and those killed by contact before emergence was complete. No counts were taken from parts of bushes from which counts had previously been taken.

TABLE I.

Exp. No.	Counted	Successfully emerged	Trapped	Killed by contact
Oil Applications				
1	May 10	120	150	166
1	May 11	391	392	120
1	May 12	315	152	30
2	May 12	527	486	163
3	May 13	55	40	37
4 & 5	No counts			
Other Treatments				
A	May 10	27	7	112
A	May 11	230	16	274
A	May 12	222	4	39
B	May 13	45	40	140
C	No counts			
D	May 11	0	565 dead; 77 alive	Checks, all emerged
E	May 11	0	1029 dead; 2 alive	

The oil sprays (Experiments 2-3) accounted for a high percentage of trapped adults, and the efficiency of the nicotine is shown by the large number which were unable to emerge successfully and were killed by contact. The resin fish oil soap spray (Treatment A) possessed very little merit in entangling the adults, but the addition of nicotine sulphate

as in the oil sprays, greatly increased its efficiency. The diminishing power of the tobacco extracts is noted on the third day when the relation of the number killed by contact to the number successfully emerged, is seen to be very much smaller. The maximum emergence was not reached until two or three days after the last count was made. As the resin fish oil soap failed to check them after the third day either by trapping the adults or killing by contact, without fresh applications, the workmen changed to the oil treatment and further experimental value was therefore complicated. The molasses treatment (Treatment B) yielded less data for comparison, as most of the plants having a high infestation had first been fumigated, or had been fumigated before much emergence had taken place. The counts were taken from one small bush, and at a time when comparatively few adults had emerged, but would indicate a good control. A steady rain through the 17th and 18th washed off the spray, however, and on the day following, when the bush was unprotected, swarms of adults emerged and oviposited in the leaves. Two more applications were given after an interval of two or three days, but only 15.4% control was obtained (See Table 2, Treatment C). The hydrocyanic gas treatments (Treatments D and E) yielded very promising results, but should not be construed in favor of this treatment without qualifications. The high kill in Treatment E is probably due to the fact that a large percentage had reached the pupal stage, rather than in a perfection of the treatment. The 79 individuals recorded as alive in both treatments were larvae. Furthermore, a very high temperature was generated in the tent during fumigation, which the operator claimed was due to some secret process in connection with the treatment. A maximum and minimum thermometer which was placed in one of the tents during fumigation, went to its limit, 130° F. All the tender young growth was killed back. Experiments using heat as a treatment probably would yield some interesting results.

TABLE II.

Exp. No.	No. of leaves infested	No. of larvae in infested leaves	No. of leaves uninfested	Percent kill
2	150	200	3300	91.0
Check	774	1474	1389	
3	189	262	2793	87.1
Check	774	1474	1389	
4	646	1087	6183	86.0
Check	2381	5513	2369	
5	313	392	2776	92.0
Check	1147	2787	610	
C	588	920	1009	15.4
Check	774	1474	1389	

The above tabulation shows the counts of newly hatched larvae

taken from the treated and check plants and the percentages of theoretical kill obtained by the various treatments. All the counts were taken in July. Twigs were taken at random, stripped carefully of every leaf, and the counts taken from these leaves.

The large counts made in order to obtain the above percentages, and the large scale on which these sprays were used, especially in treating thousands of valuable nursery boxwood, will greatly strengthen the foregoing results. So many varying conditions, such as exposure of the plants, different varieties, close or open growth, shade and sun, number of applications given, etc. afforded every opportunity for studying the effect on the plants and whether oil sprays of this type could be applied safely without a number of qualifying precautions. Outside of the slight spotting, noticeable the first day or two after the application of the spray, no perceptible signs of injury could be observed, and at this writing (Oct. 2, 1922) the treated plants are in a fine healthy condition. The results of the experiments would indicate that one or two applications of the oil at a strength of one part to twenty of water, with the addition of a pint of "Black Leaf 40" to fifty gallons of the spray mixture, given about the first of May or shortly before the beginning of emergence, will be sufficient to greatly reduce an infestation, and that a repetition of the treatment will not be necessary even after forty-eight hours of hard rain. If the first application is a thorough one, the second one should probably follow in about one week, or just before the height of the emergence. A low pressure is advisable in applying the spray.

KERNEL SPOT OF PECAN CAUSED BY THE SOUTHERN GREEN SOLDIER BUG

By WILLIAM F. TURNER, *Georgia State Board of Entomology*

ABSTRACT

Kernel spot proves to be a physiological trouble, resulting from the feeding of Hemiptera, particularly *Nezara viridula* L. As a result of such feeding the tissue of the kernel breaks down for a short distance around the puncture, resulting in a hemispherical discolored portion. This becomes bitter and imparts its bitterness to the whole kernel. Only the kernel is affected and the trouble cannot be detected until the nut is cracked. The insects can cause kernel spot only during the period when the kernel is hardening. They do not breed on pecans; only the adults feed on the nuts. Cowpeas and soybeans, being important breeding hosts, should not be used as cover crops in the orchards.

Kernel spot of pecan is, as the name indicates, an affection of the kernel. When the spots are few in number they are nearly round, as seen on the surface; when abundant, thru running together, they become irregular. At first the spots show only the slightest discoloration; later

they commence to darken and in time become very dark brown in color. This discoloration may also extend beyond the limit of the actual "spots" in severe cases. A horizontal section of the spot is almost a semicircle, the diameter being the surface of the kernel, showing that the spot is actually a more or less perfect hemisphere. This hemisphere is very distinct in that, at an early stage, it is outlined in brown, and later the entire affected area becomes discolored. An examination of the spot, in section, shows that the cells are all collapsed, giving a gross appearance of sponginess. One other characteristic is that a majority of the spots occur on the ridges of the kernels; i. e., on the portion nearest the shell. At first the affection seems to have no effect upon the flavor of the nut but after a short time the spot itself becomes bitter and this bitterness is finally imparted to the entire kernel.

Kernel spot usually affects only those varieties which have the thinnest shells, and plump meats. Thus Schley and Curtis nuts are frequently attacked very severely, as much as 50% of their crop being ruined, while such varieties as the Stuart (thick shell) and Frotcher (non-plump meat) will escape injury, though growing next to the susceptible varieties.

The trouble is of very serious importance to the growers of pecans. True it occurs only in slight amounts during most years but occasionally as in 1916 and 1921, in Georgia, fully a quarter of the crop is affected in many groves. Furthermore the losses are particularly severe in that no indication of the trouble can be seen until the nuts are cracked. As a consequence quantities of nuts are shipped in perfect good faith by the growers and pass thru the channels of trade until they reach the final consumer. The finding of spoiled nuts immediately reacts thru retailer and wholesaler to the grower and in most cases the latter is obliged to recall his product. Thus there is a loss not only of the crop itself but of the freight both ways and the good will of the public. Had the grower known of the trouble in the beginning the nuts could have been sold, at reduced prices to be sure, to the crackeries.

Very little has been published concerning kernel spot. This is probably due to the fact that the trouble has not been a major one every year. Rand first gave the trouble some attention.[1] He stated that kernel spot was a fungus disease and isolated a fungus, *Coniothyrium caryogenum* Rand, which he pronounced to be the causative agent.

In 1916 the writer observed what appeared to be a correlation between kernel spot and the use of cow peas as a summer cover crop. Several

[1]Rand, Frederick V., 1914. Some diseases of pecans. In Jour. of Agr. Res., Vol. 4. pp. 303–338.

growers noted the same phenomenon.[2] A study of the situation revealed the fact that the peas were heavily infested with the Southern Green Soldier Bug, *Nezara viridula* Linn., and that these bugs were also present to some extent on the pecans. These observations together with the fact that thin shelled varieties with plump meats were more subject to the trouble than were those which had thick shells, led to the thought that there might be a connection between the insect and the "disease."

In 1917, the writer conducted a few preliminary experiments, caging the bugs on clusters of seedling nuts. While far from being conclusive these experiments indicated very strongly that the suggested relationship was an actual one. There was no indication, however, as to whether the spot was an injury due directly to the insect or the insect acted as the carrier of a disease.[3]

In 1921 Demaree conducted a much more extensive experiment along similar lines. He attacked the problem from the pathologist's standpoint, his main purpose being to determine, in case the suggested relationship was confirmed, if the actual cause of the trouble was a disease or simply an injury directly due to the bug. Demaree's work showed conclusively that kernel spot is caused by the feeding of *Nezara viridula*, this feeding resulting in the extraction of all liquid from a hemispherical area centering about the point of attack, with a resultant collapse of the cells affected; and that no fungus or bacterial organism is concerned in the trouble.[4]

During the past season experiments have been undertaken to clear up several other points with regard to the relationship of the insect to the spot. For this series, some hundred cages were put in place during the second week in August. The varieties of pecan used were Frotscher and Teche; these varieties being chosen for reasons of accessibility altho they are not as subject to kernel spot, under normal conditions, as are many others.

Commencing on August 21, five adults of *Nezara viridula* were placed in each of 10 cages and left for a period of about 10 days. They were then removed and other insects were placed in 10 more cages. This process was followed throughout the season till harvest time. The cages were not removed until the nuts were gathered. In each case, when insects were introduced into cages, nuts were cut and photographed

[2]Credit for the first observation of this apparent correlation belongs to J. B. Wight, a pioneer grower of budded pecans, of Cairo, Ga.

[3]Turner, William F., 1918. Nezara viridula and kernel spot of pecan. In Science n. s., V. 47, No. 1220, pp. 490–491.

[4]Demaree, J. B., 1922, Kernel spot of the pecan, and its cause. U. S. Department Agr. Bul. 1102.

to show the condition of the shells and kernels. At harvest time all nuts were gathered and examined.

The following table gives a résumé of the results obtained in this experiment. The actual dates given in the table are only of general importance. These would vary in any one year, according to the variety under observation, since the ripening period varies considerably with different varieties. The time would also vary from year to year according to seasonal variations. The stages of growth and maturity of the nuts, as indicated by the photographs, give an index which will hold true for all varieties and all seasons.

TABLE I

Series	Cages	Date	No. Nuts	Results
I	1-10	8/21-9/1	24	All nuts dropped off; no spots.
II	11-20	9/1-9/11	23	All but five nuts dropped; all show spots
III	21-30	9/11-9/20	22	All kernels had spots; total of 117 spots.
IV	31-40	9/20-10/4	21	All kernels had spots; total of 187 spots
V	41-50	10/4-10/12	26	13 nuts with spots (50%); total 83 spots
VI	51-60	10/12-10/19	29	1 nut with spot: 1 spot.
Check	61-100	Harvest	136	No spot.

In studying this table it is necessary to correlate the results with the condition of the nuts. These are shown in plate 6. In series I all nuts dropped from the stems. This is clearly due to the insect attack in that none of the nuts in the check cages dropped. An examination of these nuts after they had been off the tree for some ten days did not reveal any evidence of kernel spot whatever. Plate 6, fig. 3 shows the condition of the nuts at the beginning of this period and figure 4 that at the end. It will be noted that the true condition for our consideration is most nearly like that in figure 3, in as much as the nuts all dropped within five days of the time when the insects were introduced. At that time the shell was still very soft and thin. The skin of the kernel was formed, but none of the meat, this still being in liquid condition. As a result of this condition there was nothing in the kernel in which a spot could form.

In the second series 18 out of 25 nuts dropped (72%). All of these, together with the nuts which remained on the tree, developed spots. Figs. 4 and 5 on plate 6 show the condition of the nuts at the beginning and end of this period. In figure 4, the kernels have begun to form on the inside of the skins. At the end of the period a very marked development has taken place altho the kernels are still far from plump. Through-

out this period the kernels were sufficiently formed to allow of the development of the spots.

During the time of the 3rd and 4th series, in which 100% of the nuts were affected (and none dropped), figures 5 to 7, plate 6, the shells were still fairly soft; the nuts with plenty of meat for attack; but the meats were not at all mature, and liquid could be extracted with the resultant collapse of the cells.

From the time the kernels commenced to mature, figures 7 to 8, the percentage of affection decreased. There was no change of appearance in the spots formed in this 5th period and the number per nut did not decrease materially. The nuts of course varied somewhat in their rate of development and the results obtained simply indicate that at the beginning of this period 50% of the kernels were so well hardened that feeding by the insects failed to empty the cells or to break down their walls.

After the stage shown in figure 8, kernel spot could not be produced by the insects. In series VI only one spot was produced, and this was on a kernel which was obviously not as mature as the other nuts of the series, at the time of examination.

The adult insects fed very freely on the nuts, up to the time of harvest. Even after the shucks had split the insects continued their attack, forcing themselves between the loose shuck and the shell and thrusting their beaks directly through the shells. The bugs are able to pierce the shells even when these are so hard that it requires considerable strength to crack them, as when they are ready to be harvested.

Kernel spot is caused only by adult insects. Nymphs in the last instar were confined in several cages. Of these only one was able to molt and no spots occurred on any of the nuts. Some twenty batches of eggs laid by females in the cages, were allowed to remain and hatch, naturally. All of the young molted once, since they do not feed in the first instar, but of over twelve hundred nymphs only four reached the third instar; and these died in that stage.

This brings out a very interesting point that while the pecan is a feeding host of the bug, it is not a breeding host. The insects breed most freely, in South Georgia, on legumes, and of these cow peas, soy beans and mung beans appear to be the favorites. Other common breeding hosts are okra, and cotton. Various observers have reported the species as attacking practically every garden and field crop grown in the south but, unfortunately, no attempt has been made to distinguish between breeding hosts and feeding hosts, so a complete list of the former can not be given at present.

Pecans Injured by Southern Green Soldier Bug

1. Cross section of spots. 2. Spots as seen from the surface. 3, 4, 5, 6, 7, 8 sections of nuts gathered Aug. 21, Sept. 1, 11, 20, Oct. 4 and 12 respectively.

After it had been proven that kernel spot was purely a physiological breakdown following the feeding of a bug, it seemed quite possible that other species might have the same effect. With this point in view six adults of a species of Euschistus were confined in two cages and eleven adults of *Leptoglossus phyllopus* F. were confined in three cages. The results are given in table No. 2.

TABLE II

Insect	Cage No.	No Nuts	No. Spots
Euschistus Sp.	1	2	4 & 12
"	2	2	0
L. phyllopus	1	3	0, 9 & 9
" "	2	5	0, 0, 0, 2 & 4
" "	3	3	1, 3 & 1

The spots caused by these two species appeared to be exactly like those following the attack of *N. viridula*, and these results simply confirm the conclusions already reached, as to the nature of the trouble. From the practical standpoint the interest of the grower should still be confined to the Green Soldier Bug, since that is the only species which has been found in sufficient numbers to cause any economic injury.

One thing has impressed the writer most strongly during the study of this trouble, and more particularly in the study of the literature concerning the Southern Green Soldier Bug. This is the lack of careful study directed toward an understanding of, not only this species, but of the Heteroptera in general. There seems to be no doubt that such study will solve many of our present problems as well as many of those of the plant pathologist. The field is practically a virgin one and I believe offers the best opportunity to the beginner in Entomology today.

A NOTE ON THE HONEY DEW PRODUCTION OF THE APHID, *LONGISTIGMA CARYAE* HARRIS

By WILLIAM MIDDLETON, *U. S. Bureau of Entomology*

ABSTRACT

Observations on the aphid, *Longistigma caryae* Harris, at Washington, D. C., showed that it remained active, excreting honey dew, later in the year 1922 than had been previously recorded. Weather reports reveal late excesses of temperature associated with this record and a brief summary of reports of the occurrence of the species with some extracts from literature are included.

During the latter part of October a number of complaints of annoyance by honeydew were received at the Bureau of Entomology, U. S. Department of Agriculture, from residents of Washington, D. C., Jersey City, N. J., and Philadelphia, Pa. Some examinations of trees in certain sections of the Capitol City were made on October 26, 1922, and a large aphid, *Longistigma caryae* (Harris), was found to be abundant in clusters along the under sides of large limbs on a number of sycamore shade trees. Specimens from Jersey City showed the same aphid and a brief description of a louse associated with the Philadelphia complaint agrees with this species though not to an extent permitting a positive determination. At Washington, D. C., the trunks and branches of a number of sycamores and the side-walks and fences beneath showed decided traces of the sweet liquid excreta of the aphids and a cluster low on the trunk of a young sycamore was observed to show some fresh globules of honeydew although the day was cool. Further, the dropping of this material from the trees in certain sections of the city soiled the clothing of passersby and automobiles parked and passing beneath and attracted some unwelcome insect visitors.

On the 14th of November the aphids were still present in masses and a yellow jacket (*Vespula* sp.) was observed flying about those on the young sycamore where there was still some trace of fresh moist honeydew on the bark.

Since there seems to be no previous record for production of honeydew by this species of aphid at this geographical position (Latitude 38° 53′ 17″ N. Longitude 77° 1′ 34″ W. of Greenwich, Altitude 160) so late in the year, the observation should be worth recording and it may be of interest to review the weather conditions at Washington, D. C., during the months of September, October and early November as a factor probably contributing to this possibly unusual occurrence. The summer had been warm and dry and arranged below are the weekly average temperatures, precipitations and excesses or deficiencies for the period mentioned.

TABLE I.—DISTRICT OR STATION OF REPORT, WASHINGTON
(From "Weather, Crop and Markets" Pub. weekly by U. S. Dept. Agric.)

Date of Publication 1922 Week	Period of Average	Average Temperature (±)	Total Precipitation (±)
Sept. 2	(Week ending Aug. 29)	72 (—1)	0.4 (—0.5)
" 9	(" " Sept. 5)	75 (+3)*	5.5 (+4.8)*
" 16	(" " " 12)	76 (+6)*	1.1 (+0 2)*
" 23	(" " " 19)	69 (+1)*	1.1 (0)
" 30	(" " " 26)	65 (—1)	0 (—0.8)
Oct. 7	(" " Oct. 3)	65 (+2)*	0 (—0.6)
" 14	(" " " 10)	72 (+11)*	1.0 (+0.4)*
" 21	(" " " 17)	61 (+3)*	0.2 (—0.4)
" 28	(" " " 24)	53 (—2)	0.1 (—0.8)
Nov. 4	(" " " 31)	52 (0)	0 (—0.8)
" 11	(" " Nov. 7)	55 (+5)*	0.1 (—0.6)
" 18	(" " " 14)	53 (+6)*	0 (—0.6)

In the above review of the weather the preponderance of plus or excess averages (those indicated by the *) are doubtless of especial significance in the late activities of the *Longistigma*. Not only were these apparently favorable to the aphid but they probably produced a stimulating effect on and an increase of sap in the trees which the previous rather scanty rainfall had depressed.

Bureau of Entomology notes[1] of various years on *Longistigma caryae* Harris contain the following records of occurrence for the species.

April 30	August 6, 7, 11, 17, 20 and 28
May 5	September 4, 5, 9, 9, 14, 17, 17, 21, 27 and 29
June 9 and 26	October 16 and 25
July 7 and 24	November 4

These notes point to a maximum appearance during August and September, and while recording the presence of the aphids as late as November, still show no observations on its production of honeydew on this date in the latitude of Washington.

Clarke[2] records the species in early November of 1906 at Montgomery, Alabama, (Latitude 32° 21′ N. Longitude 86° 25′ W., Altitude 222) on the undersides of limbs of sycamores. The colonies were large and honey dew abundant. Townsend[3] observed this aphid abundant on western plane trees at Washington in 1888. His note mentions the staining of the pavement beneath infested trees both in September and October. Davis[4] has recorded *L. caryae* present during October in northern Illinois but does not mention it's honeydew production at this time. Wilson[5] states that at Washington, D. C., he has observed egg-

[1]Kindly furnished by Dr. A. C. Baker.
[2]Clarke, Warren T. Ent. News, Vol. 18, pp. 187–188.
[3]Townsend, T. Insect Life, Vol. 1, No. 6, Dec. 1888, pp. 197–198.
[4]Davis, John J. Jour. Econ. Ent., Vol. 3, p. 413.
[5]Wilson, H. F. Can. Ent., Vol. 41, 1909, p. 385.

laying females as late as December 2 but includes no information concerning honeydew production at this time of year. Weed[6] records sexed forms in late September and in entire October but makes no mention of late honeydew production. Finally Sanborn[7] reports the aphid enduring all temperatures to 0° F. but gives no information regarding its production of honeydew at low temperatures.

According to the information in the Bureau of Entomology files this species of aphid has a wide range of host plants but the above record of its late production of honeydew at Washington, D. C., is made only from observations in which sycamore served as the host.

LIFE HISTORY OF *MICROMUS POSTICUS* WALKER[1]

By C. R. CUTRIGHT, *Ohio Agriculture Experiment Station, Wooster, Ohio*

ABSTRACT

The Hemerobiid larva, *Micromus posticus* Walker was collected with other aphid predators, the life history worked out and an estimate of its economic status made.

While collecting aphid predators in the field during the summers of 1921–22, a Hemerobiid larva was noticed quite often. A number of these were brought into the laboratory where they were bred out, the adults proving to be those of the brown lacewing, *Micromus posticus* Walker. An attempt was then made to obtain literature dealing with this insect but nothing except the description of the adult and a few casual notes dealing with the larva were found.

REARING

The eggs that were brought in from the field were placed in vials closed with a cotton plug. As soon as they hatched the young larvae were transferred to inverted petri dishes where they were provided with aphids as food. This method of rearing was very successful but one difficulty was encountered. The first instar larvae are very small and the exuviae can not be detected by the naked eye. In order to determine the time of ecdysis it was therefore necessary to make a microscopic examination of the contents of the dish each day. In order to have a smaller quantity of material to examine the young larvae were placed on white paper and a very small, thin watch glass inverted over them. Aphids were then introduced independent of any plant tissue. Exami-

[6]Weed, Clarence M. Insect Life, Vol. 3, pp. 286–287.

[7]Sanborn, Charles Emerson. Kans. Univ. Sci. Bull., Vol. 3 (1904) p. 30.

[1]Contribution No. 71, from the Dept. of Zoology and Entomology, Ohio State University.

nation of everything under the watch glass could then be made with little trouble and in this way the number of larval instars was established.

Life History

The eggs are found on the underside of the leaves of plants, usually those that are infested with aphids but not always. They are placed in irregular groups, containing one to thirteen eggs each, some may touch but others may be a centimeter or more apart. The long axes of the eggs frequently parallel each other but exceptions to this are almost the rule. They lie perfectly flat on the leaf surface to which they are rather insecurely attached. There is no sign of the egg being stalked. Eggs were collected in the field from June to the first of October. Though never abundant a few hours search would usually bring several to view.

Females that were confined in cages with aphid infested plants placed the eggs in the same relative position as those found in the field. When they were confined in vials or in petri dishes the eggs were deposited on the nearest convenient surface regardless of what it was or of its position relative to light.

Several incubation records were taken in August and September. The average length of time required for hatching is four days with variations of only a few hours, more or less, from this period.

The larvae are easily the most conspicuous of the different stages. Their usual habitat is, as might be expected, plants that are infested with aphids, where they are found on the lower surfaces of the leaves or running up and down the stems. I have collected them usually on herbaceous plants. Banks states that they are common on aphid infested trees where they are found on the leaves.

The larvae, in hunting for food, move about the leaf changing direction frequently. If the movement is slow the tip of the abdomen is usually attached to the leaf, the legs carry the body forward till it is stretched out as far as possible. The tail is then released, the abdomen is humped up and the tip re-attached. If the movement is rapid the abdomen is carried elevated, not touching the leaf, usually being humped about the fourth and fifth abdominal segments. All the time that movement is going on the head is continually being shifted jerkily from side to side. This is a very characteristic action on their part.

The palps and jaws seem to be the structures used in locating food. The antennae touching the aphid bring very little response on the part of the larva. When a live aphid is located the head is drawn back and then thrust sharply forward, the mandibles piercing the body wall. I

believe this thrusting motion to be necessary on account of the comparative straightness of the mandibles. Were they more curved a pincher-like action might be used. After a hold has been secured by the mandibles violent struggles and extrusions of glue on the part of the aphid usually fail to secure its release. The larvae hold on tenaciously, bracing themselves with their feet, and frequently anchoring themselves by the tip of the abdomen. Every cast skin or sucked out aphid body that is encountered in the search for food is attacked as though it were alive. Skins such as these frequently become caught on the mandibles in which case the larva will wipe its jaws across the surface of the leaf in order to rid itself of them. Occasionally the aphid is held high in the air on the points of the mandibles for several minutes while feeding is in progress. Also if the larva is disturbed it will hold the aphid in this manner while running away.

A first instar larva will require from two and a half to three and a half hours in destroying a half grown cabbage aphid. Larvae of the third instar will destroy them in from five to fifteen minutes depending on the size of the aphid.

In addition to aphids the larvae have been found feeding on the eggs of Coccinellids and of the cabbage butterfly, also on those of their own species. Feeding on their own eggs does not usually take place if all eggs are of the same oviposition period as these hatch almost at the same time. However if two different groups of eggs are placed together the larva of the group first hatching invariably find and destroy the eggs of the second.

The larvae have only three instars. The method used in determining this point has already been described under rearing. Table I is the record of sixteen larvae that were carried from egg to adult. It includes the length of the incubation period, the length of each individual instar, and of the inactive period spent by the larva in the cocoon before the final moult to the pupal stage. Averages and totals for the table are included.

From Table I we find that the first instar averages two and a half days in length, with a maximum of four and minimum of two days. The average length of the second instar is one and a half days with a maximum and minimum of two and one respectively. The third instar is much longer averaging four and a quarter days but over half of this period is spent in spinning the cocoon and lying inactive before the final moult. The total larval period averaged slightly over eight days with nine as the maximum and seven as the minimum length.

TABLE I.—LENGTH IN DAYS OF EGG STAGE, LARVAL INSTARS, AND PUPAL PERIOD OF *Micromus posticus* WALKER

Larva number.	Egg	1st Instar	2nd Instar	3rd Instar active and Pre pupal period	Pupa	Larval stage	Egg to adult	Preoviposition period	Egg to egg
1.	4	2	1	2	2	5	7	16	
2.	4	2	1	2	2	5	7	16	
3.	4	2	1	2	2	4	7	15	
4.	4	2	2	2	2	5	8	17	
5.	4	2	2	2	3	4	9	17	3 days 20
6.	4	2	2	2	3	4	9	17	
7.	4	3	1	1	3	5	8	17	
8.	4	2	2	1	3	5	8	17	
9.	4	2	2	1	3	5	8	17	
10.	4	3	2	1	3	5	9	18	
11.	4	3	1	2	3	3	9	16	
12.	4	3	1	2	3	3	9	16	
13.	4	3	1	2	2	4	8	16	4 " 20
14.	4	2	2	2	2	4	8	17	
15.	4	4	1	2	2	4	9	17	3 " 20
16.	4	3	1	2	2	4	8	16	
Totals	64	40	23		68	64	131		
Averages	4	2½	1½		4¼	4	8+		

Table II constitutes the feeding record of the sixteen larvae from which the data were obtained for Table I. Figures at the top of each daily square show the number of aphids available as food and those at the bottom give the number destroyed. (See next page)

The following tabular summary of Table II is given showing the average, the maximum, and the minimum number of aphids eaten in each stage.

	Ave.	Max.	Min.
First Instar	10	16	4
Second "	11	21	3
Third "	20	28	3
Total period	40	56	27

The averages show that feeding is about the same in the first two instars and that the third practically doubles these two in amount of food consumed. The small amount of food used is especially noticeable when it is compared with the larval feeding records of the Coccinellids, where averages of from one hundred to six hundred aphids destroyed are not uncommon.

After the third instar has progressed several days (see Table I) the larva spins a very loose meshed almost circular cocoon which will measure from seven to eight mm. in diameter. This will correspond roughly to the length of the larva, as it is spun without curling up. We now have a structure somewhat resembling two saucers placed together, concave surfaces joining with the larva inside. This outer cocoon is really a

TABLE II. LARVAL FEEDING.

Larva No.	Aug. 12	Aug. 13	Aug. 14	Aug. 15	Aug. 16	Aug. 17	Aug. 18	Aug. 19	Aug. 20	Aug. 21	Aug. 22	Aug. 23	Aug. 24	Aug. 25	Aug. 26	Aug. 27	Aug. 28	Aug. 29	Aug. 30	Aug. 31	Sept. 1	Sept. 2	Sept. 3	Sept. 4	Sept. 5	Sept. 6	Sept. 7	Totals	1st Instar	2nd Instar	3rd Instar
1	6 2	5 5	6 3	10 10	10 10			P																			30	7	3	20
2	5 2	8 7	6 6	11 11	18 16			P																			42	9	6	27
3	8 5	10 9	14 13	8 8	13 12			P																			47	14	13	20
4	5 5	5 4	6 5	6 5	7 7	10 9			P																		35	9	10	16
5						6 5	8 7	8 7	9 9	9 32				P													31	5	14	12
6						21 4	11 10	12 11	21 20	23 11				P													56	4	21	31
7								8 6	13 9	15 9	14 3				P												27	15	9	3
8								18 8	17 8	33 21	16 16	29 2			P												52	15	21	18
9								11 5	13 10	10 7	9 9	17 0			P												31	15	7	9
10								6 1	11 5	15 2	10 10	23 22	9 6			P											46	6	12	28
11													5 2	6 5	8 2	10 10	16 11				P							30	7	12	11
12													8 6	10 9	11 3	11 11	18 11				P							40	15	3	22
13																7 5	11 9	7 6	12 12	10 8			P					40	14	6	20
14																8 8	9 6	10 10	22 19	11 8			P					51	8	16	27
15																6 5	10 4	6 6	10 8	17 16	7 7			P				39	15	8	23
16																10 9	10 7	12 10	9 9	12 12			P					47	16	10	21
																											Average totals	40	10	11	20

framework to support the inner, which is now constructed. The larva doubles or curls up and now spins an oval, much more closely meshed cocoon which may be placed either along the sides or in the center of the outer one. It will measure about 5 mm. in length by 2.5 mm. in width. The larva can be distinctly seen through both of these loose silken envelopes. Three to four hours will be used in spinning the outer case. Construction on the cocoon proper is slow and it is hard to tell exactly when work on it ceases.

The silk is spun from the anus, the larva moving the tip of the abdomen hesitatingly back and forth, up and down, and changing the position of the body frequently.

After two or three days in the cocoon the final larval moult takes place (see tables) and the pupa stage proper commences. The shriveled exuvium remains at the tip of the abdomen.

The place of pupation has not been accurately determined. It is probable however that it rarely takes place on the plant on which the larvae have found their food. Two things lead me to believe this; first, though I have constantly looked for them in the field, that is on plants, I have never found the pupa. Second, several larvae in the third instar were placed on plants infested with aphids. When ready to pupate they left the plant and pupated under some card board that was used to support the base of the "chimney" cage. It is probable therefore that the larva pupates under clods, stones or refuse or possibly in the soil.

The pupal periods for sixteen individuals are shown in Table I. The average length of time required by this group for transformation was four and a fourth days.

In emerging the pupa works its way out through one end of the cocoon and through the outer envelope, the emergence of the adult taking place on the outside or within a few mm. of the cocoon. So loosely are the two envelopes woven that the path of emergence is hard to see.

The adults are more active at dusk but may be seen flying in dense shade and on cloudy days. On bright days they are usually found resting quietly on the undersides of leaves and are not easily disturbed.

I have noted them as most abundant on herbaceous plants, such as rape, etc., and also on white pine infested with *Dilachnus strobi*. None have been observed feeding in the open. In the laboratory where adults were kept without food for several days feeding would take place during the day when aphids were given them.

The adults are practically always found on or about aphid infested plants or trees. A few have been taken early in the morning on the

outside of windows where they had evidently been attracted by the heat radiating from within.

Mating has not been observed and is evidently either a very short or a nocturnal operation. It is of interest to note that copulation does take place, as is proven by the hatching of the eggs, in such a limited space as that under an inverted petri plate.

Records of the preoviposition period were secured in three instances. Two of these were three and the other was of four days in length. The individuals making these records are shown in Table I.

The place of oviposition in both the field and the laboratory has already been discussed. The following egg-laying records were secured from females confined under petri dishes.

TABLE III.—EGG RECORDS OF *Micromus posticus*.

																				Totals
No. A	0	0	0	38	68	0	0	0	0	0	Dead.									106
" B	0	0	0	0	21	19	31	11	0	0	"									Dead 82
" C	0	0	0	0	18	12	42	46	21	18	3	16	3	13	34	8	6	2	0	246
																				Average 144

Table III gives a difference of from eighty-two to two hundred and forty-six eggs per female with an average of one hundred and forty-four each. The period over which the eggs were laid is of interest, in one case lasting only two days while in another it extended over two weeks. The number of eggs laid indicates that the insect has fair reproductive powers and but for weak spots at other points in the cycle would be much more common.

Observations made on the feeding of the adult seems to indicate that the rate is little higher if any than in the case of the third instar larvae where the number of aphids destroyed daily averaged about ten.

The following table deals with the length of life in the adult.

TABLE IV.—LENGTH OF ADULT LIFE

Adult No.....	1	2	3	4	5	6	7	8	9	10	11	12	13
Days Alive....	8	14	21	35	35	36	32	32	10	11	19	6	10

From the above we find that the average length of life was twenty-one days. All the above individuals were reared in captivity during the months of August and September. It can only be guessed that adults in the open live for a longer time but it is probable that they do.

In the spring adults have been noted on aphid infested white pine during the month of April. Table I shows that the period from egg to egg may be passed over in twenty days. If we consider the breeding season as lasting from May until October we have a possibility of four, five or even more generations. The number of generations combined with the reproductive ability of the females should produce a large

number of individuals during the course of the season. No great increase however was noted in the field.

The adults probably overwinter. In support of this supposition three adults were taken in the field about the middle of October. These were placed in an outdoor cage and fed as long as aphids were obtainable in the open. On the twentieth of December two of the adults were still alive though freezing weather had been the rule for several weeks. When next examined on Jan. 2, these two were dead. The fact that they lived for a period of over two months in the open, under winter conditions would seem to indicate that some individuals would successfully overwinter. There is also a possibility that the pupa overwinters but the extreme frailty of the case seems to be an objection to this idea.

No parasites have been reared from any stage of this species nor have any signs been noted that would indicate parasitism. As far as we have been able to find there is also freedom from disease.

Descriptions

Since this work has been completed, the egg and all immature stages of *Micromus posticus* have been described and illustrated by Dr. R. C. Smith. (See Annals of the Entomological Society of America Vol. XVI, No. 2, p. 145–146 and Plate VII). The adult was first described by Walker in "The British Museum Catalogue of Neuroptera," p. 283, 1853. Descriptions are also found in "A Synopsis of the Neuroptera of North America," p. 204, 1861, by Hagen and in "The Transactions of the American Entomological Society," Vol. XXXII, p. 45, 1906, by Banks. In this publication it is mentioned as common throughout the eastern and southern United States. It is also stated that the larvae are found usually on trees and that about ten days are required for their development.

Economic Importance

In the neighborhood of Columbus and Wooster during the past two summers this insect was of little economic importance in controlling aphids. Many counts of aphid predators taken in the field showed that in numbers this species was far in the minority. Attention may also be called to the low rate of feeding that is common to both predaceous stages. Banks ('06) states that they are common on aphid infested trees but the word common may be used by the collector in a far different sense from what it would mean if used by an economic entomologist. The number of eggs per female and the several generations per year would lead us to expect that the insect would increase rapidly during the

breeding season. This however did not seem to be the case. The adult insect is rather fragile and it is thought that storms might work considerable destruction among them. The same might also be said of the first and second instar larvae which are quite frail. It is known that the first instar larvae can not live as long without food as can Coccinnellid larvae. Other factors of weakness are unknown.

BIBLIOGRAPHY

BANKS, NATHAN.
1906—Transactions of the American Entomological Society, Vol. XXXII, p. 45.
HAGEN.
1861—Synopsis of the Neuroptera of North America, p. 203.
SMITH, R. C.
1923—Annals of the Entomological Society of America, Vol. XVI, No. 2, pp. 129–148.
WALKER.
1853—British Museum Catalogue of Neuroptera, p. 283.

A VALUABLE SNAIL POISON

By A. J. BASINGER, *Assistant Entomologist, California State Department of Agriculture, Sacramento, California*

ABSTRACT

A mash made of one part calcium arsenate and sixteen parts bran was used successfully as a poison bait in eradication work against *Helix pisana* at La Jolla, California. It is now giving splendid results in the control of *Helix aspersa*.

During a campaign to eradicate a foreign snail, *Helix pisana*, that was gaining a foot-hold at La Jolla, California, we succeeded in developing a very valuable snail poison that has proven successful not only against *Helix pisana* but also against the Brown Snail, *Helix aspersa*. This is an European species of wide distribution in America and of considerable economic importance. In conducting a series of experiments to determine the best means of combating *Helix pisana* we tried a mash composed of calcium arsenate and bran which we adapted from Lovett and Black[1] who used calcium arsenate and chopped lettuce leaves in the control of slugs. The calcium arsenate and bran proved so potent a weapon against *Helix pisana* which now is practically anihilated that we attribute a large portion of our success in the campaign to this poison. *Helix aspersa* occurred also in the same areas treated for *pisana* and now it, too, is scarce in those areas. There is no doubt but that other species of snails could be controlled by the same remedy.

The poison is made up at the rate of one part of calcium arsenate by weight to sixteen parts of bran. The ingredients are thoroughly mixed dry and then water is added to make a moist but not wet mash. It

[1]Lovett and Black, The Gray Garden Slug. Oregon Agricultural College Experiment Station Bulletin No. 170, June 1920.

must be dry enough so that it will scatter nicely when tossed out with the hand. The infested areas should first be sprinkled with the garden hose, where water is available, as this brings out the snails and keeps the mash moist and palatable. It is preferable to do this in the evening. The poison bait is then broadcast over the infested areas as in sowing grain. It is desirable to toss it lightly over plants so that particles of the poison bran will lodge on the foliage as well as on the ground. The application should be followed each evening for four or five days by a wetting with the garden hose unless the work is done during rainy weather. The poison is very stable and does not loose its efficiency even after being wet each evening for a week or more. We gathered some of the dried particles of poison bran from the ground after it had been wet every evening during six days and it proved fatal to snails that fed on it. This is a slow acting poison and the results from an application should not be judged until two or three days later.

In an experimental plot we secured a kill of 96% out of 6431 active *Helix pisana* in six days. The results during our practical applications were fully as satisfactory. In a treatment applied to a flower bed infested with *Helix aspersa* 86% of a total of 588 snails were dead from the poison at the end of three days. This percentage would have been much higher had the experiment been continued two or three days longer. The following is a copy of a letter from a man in charge of an estate of about ten acres at Pasadena, California, who used the poison bait for *Helix aspersa* according to the directions given herein and was kind enough to report the results.

"Dear Sir:

The day following your visit to our place at the above address I prepared and carefully broadcasted the preparation for the extermination of snails over the entire canyon and the flower gardens. This covered the areas where the snails were the most plentiful. We followed this work during the following week with very liberal spraying over the entire area each day as much as possible and I am glad to report that the result is very gratifying. In fact it is better than I had hoped for. During the past three days I have spent my entire time in cleaning out leaves and old plants through this part of our grounds and have found hundreds of snails and out of the many hundreds only two that were alive. One was in the vegetable garden back of the house where you found the large snail that you took with you as a specimen and the other on a branch of an oak tree.

Very truly yours,
A. H. GREGORY
1504 So. Marengo Ave., Pasadena, California.

This poison bait is now being distributed in considerable quantities through the office of County Horticultural Commissioner R. R. McLean

in San Diego County, California, for the control of the Brown Snail. Being simple, inexpensive and efficient we feel that it may be used to advantage in other parts of the country and perhaps on other species of snails.

Scientific Notes

A Tingid attacking quince. In June the writer observed several quince trees, the leaves of which were noticeably injured by the feeding of Tingid nymphs and adults. The leaves were mottled with brown and in some cases almost entirely brown as a result of the feeding punctures.

Adults were submitted to Prof. C. J. Drake who identified them as *Corythucha cydoniae* Fitch.

J. R. Stear

Ormenis pruinosa Say—A Fulgorid on Apple and Peach. This Fulgorid was quite common on apple and peach in Cumberland Valley orchards this season. The white woolly nymphs clustered along the twigs resembled woolly aphids in appearance and were frequently mistaken for them. No injury was observed as a result of their feeding. Reared adults were determined for me by Prof. J. G. Sanders.

J. R. Stear

Chambersburg Laboratory, Penna. Bur. of Plant Industry

Swarms of Cotton Moths: Swarms of the cotton moth, *Alabama argillacea* Hubn., appeared in Bridgeport, Conn., September 12. According to the newspapers they were so abundant in the streets as to cause the skidding of automobiles which crushed and passed over them. Be that as it may, they fluttered over and rested upon the show windows and flew into the faces of pedestrians and automobilists. Mr. Zappe observed them resting on light posts and the walls of buildings all over the city. They literally covered the posts of the "white way" lights in Bridgeport, and he also observed them in Stamford. The moths were also present in New Haven, though much less abundant. In 1911 a similar swarm of these moths occurred in New Haven the last week in September, and in 1912 the moths also appeared, though in much smaller numbers and not until October 11 and 12.

W. E. Britton

The European Earwig in California: The writer wishes to announce the discovery on August 31, 1923, of large numbers of the European earwig, *Forficula auricularia* Linn., in West Berkeley, California. The origin of the infestation is not known but it is claimed by residents of the infested area that it has been under observation for at least four years. As yet no apparent damage has resulted from its presence and it would not have been reported had it not been for the fact that great numbers collected on the front porch of one of the residences during a vacation period. So repulsive were these to the owner that a few specimens were sent in for identification. The specimens were compared with those received from Seattle, Washington, in 1916, and proved beyond a doubt to be the European species.

The infestation has been reported to the State Department of Agriculture in view of the seriousness of the earwig menace in Oregon as reported by A. L. Lovett

in the *Oregon Grower*, August, 1923. According to Professor Lovett the earwig is a real menace to agriculture as well as a household nuisance of the first magnitude.

E. O. Essig

Scutellista cyanea **Mot. recovered at New Orleans, La.**—Those familiar with the literature of this parasite will recall that it was liberated to attack the barnacle scale, *Ceroplastes cerripediformis* Comst., at Baton Rouge, La., in 1897 by Dr. H. A. Morgan then entomologist of the Louisiana Experiment Stations. The original material was sent to Dr. Morgan from Washington, D. C., by Dr. L. O. Howard who had received it from Dr. Leonardi in Italy; and Mr. Alexander Craw in 1903 also sent to Dr. Morgan a quantity of *Saissetia oleae* Bern., parasitized by Scutellista from California.

Dr. Morgan states in correspondence with Mr. Ed. Foster of the Louisiana State Department of Agriculture and Immigration that *Scutellista cyanea* was liberated only at Baton Rouge, La., and in July of 1897. Careful searches made several years after liberation failed to reveal a single individual. It was therefore supposed to have died out, and this, its first recovery after more than twenty-five years and at a point over 110 miles distant from the place of liberation, seems very remarkable.

The rather light infestation of the black scale, *Saissetia oleae*, on *Nerium oleander* and varieties in this city, led the writers to make a short inquiry as to the part which parasites might be playing in holding this scale in check here. Accordingly, liberal quantities of oleander branches infested with black scale were collected and caged on May 4, 7, 10, and 12, at which times many exit holes could be seen in the scales; in some instances living parasitic larva and pupae could be found by removing scales at random, and one scale thus removed contained three pupae. As a result numerous parasites emerged on May 11th and on subsequent dates up until June 20th, shortly after which time the cages were discontinued due to drying of the material. These parasites were identified as *Scutellista cyanea* Mot., which identification was later confirmed by Mr. Gahan of the United States National Museum.

About 80 or 85% of the black scale on oleander in New Orleans seem to be parasitized by this insect.

H. K. Plank
Thos. F. Catchings

An Outbreak of *Amorbia humerosana* **Clem. on Apple:** A serious outbreak of the Leaf-roller, *Amorbia humerosana* Clem. has been found in York County, Pennsylvania. The species has been present in small numbers for a number of years and attention was previously called because the insect might probably become an apple pest. The writer has collected the species from apple from ten counties in Pennsylvania. It feeds also on Poison ivy, Spice bush, Pine and Huckleberry. The injuries resemble those of *Eulia velutinana* Walk. but the scars are larger and deeper. The species is one brooded, the larvae mature towards the end of August or first of September. They winter as pupae and the adults issue in April and May of the following year.

S. W. Frost, *State College, Pa.*

An Important New Pest of Beets in Porto Rico. *Disonycha laevigata* Jacoby is the determination given by Mr. G. E. Bryant, of the Imperial Bureau of Entomology, of a Chrysomelid which has recently become very abundant in Porto Rico. The beetle is about 4.5 mm. long, bright orange-red in color, with eyes, antennae except two basal segments, apical half of tibiae and all of tarsi, black and finely pubescent; the elytra bright green, shining and impunctate. Dr. E. A. Schwarz

states that there are specimens of this beetle in the National Museum collected many years ago in Jamaica. The writer first noted it feeding on the leaves of cultivated beets at Haina, Santo Domingo in 1920, and the first record in Porto Rico is feeding on the leaves of *Amaranthus* spp. at Guanica, Aug. 16, 1921. In December, 1922, a young planting of beets at Rio Piedras was entirely destroyed by these beetles, and a month later millions of them were found on the leaves of young plant cane and bean plants at Guanica. *Amaranthus* spp. are common weeds in these fields and large amounts of the normal host had been destroyed in preparing the fields for cultivated crops. The beetles were not feeding on the bean or cane leaves, merely hiding or resting on them. During the winter the beetles became very abundant about Mayaguez, attacking "beets, chard, eggplant and many other vegetables," and Prof. R. E. Danforth assigned the working out of their life-history to his advanced students in Entomology at the College of Agriculture there. In June, the writer noted a number of blackbirds, *Holoquiscalus brachypterus* (Cassin), walking about the shore of a small saline lagoon at Hatillo, and on closer examination it was found that they had presumably been attracted by the large numbers of this beetle feeding on a weed, *Philoxerus vermiculatus*, which had been defoliated and killed out over a considerable area by them.

GEORGE N. WOLCOTT

The Cave Cricket, Ceuthophilus, as a Possible Vector of Pathogenic Organisms. During the past summer spent at a camp on Lake May (or "Goose Pond" as it is called by the natives), near Lee, in the Berkshire Mountains of Western Massachusetts, the numerous cave crickets (Ceuthophilus) found crawling about in the open privies characteristic of the camps on the lake, attracted my attention. Since cave crickets similar to those found in the privies were observed walking over the food on pantry shelves, it occurred to me that these insects are a potential menace under camp conditions, and I have been greatly surprised to find no reference to Ceuthophilus in the rôle of a vector of pathogenic organisms, in the literature on insects and disease available to me at this time!

People in ill health frequently resort to mountain camps to recuperate, and under such conditions, it would be expected that the excreta in the privies would in some instances be contaminated with the bacilli of intestinal tuberculosis, or even of typhoid fever, and similar pathogenic organisms occurring in the digestive tract of human beings. It is quite conceivable that Ceuthophili walking over such contaminated material, and later finding their way to the kitchens and pantries near by, might readily contaminate any food over which they might crawl; and if such food were eaten uncooked, it is quite possible that infection might result, especially in persons whose resistance to disease was weakened, and who had come to the mountains in a "run down" condition, to rest and recuperate.

Since Ceuthophilus is usually a crepuscular or nocturnal wanderer, one is usually unaware of the numerous crickets prowling about his pantry shelves, and this doubtless accounts for the fact that we do not hear more about the danger of these crickets carrying disease under camp conditions. It seems to me, however, that the menace is a very real one, and the rôle of Ceuthophilus as a potential vector of pathogenic organisms under rural conditions, is a subject worthy of further investigation.

G. C. CRAMPTON, Ph.D.,
Massachusetts Agricultural College, Amherst, Mass.

The Oriental Peach Moth (*Laspeyresia molesta* Busck.). Since the note appearing in the August number of the JOURNAL, several serious outbreaks of this pest have been found in Pennsylvania. Through the efforts of Mr. E. M. Craighead of the Niagra Sprayer Company, several serious infestations have been found in the vicinity of Collegeville, Pa. Twenty-five percent of the early varieties and sixty percent of the late varieties show injury. The injury in the latter case is so serious that it will not pay to market the fruit. Orchards in the vicinity of York, Pa. show from ten to twelve percent injury. The pest has been found in noticeable numbers in York, Adams and Franklyn counties, Pennsylvania. The larvae of the fourth generation pupate chiefly at the stem end of the fruit. Some adults issued on September 7th making preparations for the fifth generation. On the bearing trees the injury was found most serious on the fruit, while on the non-bearing trees the injury was confined to the terminal shoots.

S. W. FROST, *Pennsylvania State College.*

THIRTY-SIXTH ANNUAL MEETING OF THE AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

The thirty-sixth annual meeting of the American Association of Economic Entomologists will be held at Cincinnati, Ohio, December 29, 1923 to January 2, 1924, inclusive.

Details in regard to the exact place of meeting or concerning hotel headquarters are not available at this time as final arrangements have not been completed.

The Section on Apiculture will meet at 10 A. M., Saturday, December 29. The Section on Horticultural Inspection will meet at 1.30 P. M., on the same day.

The opening session of the general association will be held at 10 A. M., Monday, December 31st. On that evening at 8 P. M., the meeting of the Insect Pest Survey and Extension Entomologists will be arranged.

Applications for membership should be filed with the Secretary as soon as possible and should be accompanied with a fee of $3.50. Blanks can be secured from the Secretary or the chairman of the membership committee.

A. F. BURGESS, *Secretary,*
Melrose Highlands, Mass.

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

OCTOBER, 1923

The editors will thankfully receive news matter and other items likely to be of interest to our readers. Papers will be published as far as possible in the order of reception, except that papers of reasonable length may be accepted in the discretion of the editor for early publication, at $3.00 per page for all matter in excess of six printed pages; in the case of other matter, the maximum of 2,500 words is still operative. Photo-engravings may be obtained by authors at cost.

Separates or reprints, if ordered, when the manuscript is forwarded or the proof returned, will be supplied to authors at the rates given below. Note that the number of pages in a reprint may be affected somewhat by the make-up, and that part of a page is charged as a full page. Carriage charges extra in all cases. Shipment by parcel post, express or freight as directed.

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A greatly depleted supply of lumber and high prices have brought all phases of the forestry problem to the front. There are highly developed systems for fire protection in some areas and large sums are being expended for reforestation. Both of these are extremely desirable, yet insects, as shown by the investigations of Dr. Hopkins, are responsible for greater losses in our forested areas than the more spectacular fires. Comparatively little has been done in the development of practical methods for reducing insect depredations in woodlands. This is something that must come in the near future and is being developed in portions of the United States and Canada, work in the latter country being stimulated largely by the extensive depredations of the spruce bud worm.

The resumé given on preceding pages of this issue is a most fitting tribute to an earlier worker. It should result not only in giving credit where credit is due but also serve to call attention to an exceedingly important and difficult line of work which should receive more attention from entomologists. The extensive planting of young trees in connection with reforestation programs is resulting in more problems, since experience has shown that certain insects are not slow to take advantage of the situation. Forest entomologists must develop methods which will make the new plantings reasonably safe from injury as well as devise means for reducing insect injury to the older growth and various forest products. Insects affecting shade and park trees have so much in common with forest insects, that the two should not be separated. It is illogical to spend large sums for fire protection of woodlands and for reforestation, both highly desirable, and allow these efforts to be nullified to a great degree by preventable insect depredations. In other words, a chain is no stronger than its weakest link. Can the entomologist aid in making a stronger chain?

Reviews

Manual of Entomology with Special Reference to Economic Entomology, by H. MAXWELL LEFROY, Professor of Entomology, Imperial College of Science and Technology, pp. i–xvi, 1–541, 4 plates and 179 text figures. Price, $11.75. New York, Longmans, Green Co.: London, Edward Arnold & Co., 1923.

The author in elaborating a portion of his lecture course on economic entomology has given a general account of all groups of insects with special reference to their immature stages, biology and economic importance. He emphasizes identification, a prerequisite to efficient control in many cases. His personal acquaintance with the faunæ of temperate and tropical climates makes possible an unusually comprehensive and authoritative volume, the value of which is not lessened by occasional reference to American insects.

The treatment is upon a systematic basis and largely by groups with comparatively little attention to individual species. The discussion of the 1500 Scolytidæ or Ipidæ, for example, being limited to less than two pages. The volume is suggestive rather than exhaustive and unlike many American works, there are no extensive bibliographies, the author limiting himself to brief citations of catalogues or monographs, thus compelling the student to use such bibliographic aids as *Zoological Record*, *Genera Insectorum* and the *Review of Applied Entomology*.

The book is designed for use with a collection and compels actual acquaintance with insects. There are no keys for the identification of species and the relatively few illustrations simply give assistance here and there, although the salient characters are given for each group. The author recognizes 26 orders, the accounts of the Protura and Zoraptera being particularly welcome.

There are hosts of facts in this rather large, concisely written volume of much interest to entomologists throughout the world, and though primarily British, it has a much broader scope. E. P. F.

Insecticides and Fungicides, Spraying and Dusting Equipment, A Laboratory Manual with Supplementary Text Material, by O. G. ANDERSON and F. C. ROTH, pages i–xvi, 1–349, 70 figures. John Wiley & Sons, Inc., New York, Chapman and Hall, Limited, London, 1923.

Part I of this volume is a laboratory manual on insecticides, fungicides and appliances. It consists of 172 pages devoted to laboratory exercise on insecticides, fungicides, combination sprays, miscellaneous materials, such as weed killers, whitewash and sterilization by steam, fumigants, spraying equipment and cost problems, designed to give practical experience in the preparation of materials and a good idea of the nature of spraying and dusting apparatus, citations of the more important literature being given with each exercise. It is an admirable laboratory manual.

Part II, pages 173–334, includes comprehensive accounts of methods of controlling insects and plant diseases and extended and very practical discussions of sprayingi and dusting equipment, cost of operation and directions for operating a gas engine,—literature being freely cited.

The general reader will find much of practical value in Part II, especially orchardists. The impartial up-to-date, discussion of spraying and dusting should be extremely valuable to many large growers. We have in this volume a comprehensive, authorative discussion of numerous practical phases of pest control. The book should not only be in the hands of students, but also in all horticultural libraries and upon the shelves of most fruit growers and others more or less directly concerned in the control of insects and fungi.

Current Notes

Mr. H. G. Barber of Roselle, N. J., worked at the U. S. National Museum during the month of July.

Dr. Carl J. Drake of the Iowa State College and Station has recently recovered from a severe attack of pneumonia.

Mr. Harold C. Hallock has accepted an appointment in biological work with parasites of the Japanese beetle at Riverton, N. J.

Professor Z. P. Metcalf, Professor of Zoology and Entomology in the North Carolina State College and Entomologist of the North Carolina Experiment Station, has been appoined Director of Resident Teaching in the College of Agriculture.

Mr. S. A. Rohwer of the U. S. National Museum, recently spent a few days comparing specimens in the collections in the American Museum of Natural History, New York, and in the Philadelphia Academy of Natural Sciences.

Mr. Oliver I. Snapp of the U. S. Peach Insect Laboratory, Fort Valley, Ga., addressed the forty-seventh annual meeting of the Georgia State Horticultural Society at Cornelia, Georgia, August 23, on "Spraying Materials and Practice."

Professor J. S. Houser attended the joint summer field meeting of the Ohio and Pennsylvania State Horticultural Societies, which included an automobile tour of orchards and vegetables garden in western Pennsylvania and eastern Ohio, July 31-August 3.

A popular lecture on the subject of "Chiggers" was given by Professor T. H. Parks from the radio broadcasting station WEAO at Columbus, Ohio, August 2nd. This comprised part of an entertainment program put on by faculty of the Ohio State University

Professor W. C. O'Kane is Secretary of the New Hampshire Academy of Science. At the fourth annual meeting of the Academy, Professor J. H. Gerould read a paper on "Lethal Hereditary Factors in Butterflies."

Dr. Roland F. Hussey and his wife (Dr. Butler) have been appointed to positions in Washington Square College, a branch of the College of the City of New York. Both received the doctorate at Bussey Institution last June, and both will teach zoology.

Mr. H. S. Adair who has been assisting with plum curculio studies at the Peach Insect Laboratory of the U. S. Bureau of Entomology at Fort Valley, Ga., has been appointed Junior Entomologist in the Bureau to assist with pecan insect investigations at Thomasville, Ga.

Dr. J. Munroe, Forest Entomologist for the British Forestry Commission, and who is attending the Imperial Forestry Conference, visited the Entomological Branch, Ottawa, Can., on July 23rd, and spent a considerable part of his time with the officers in the Division of Forest Insects.

Mr. Carl Heinrich of the U. S. National Museum recently visited the collections of the American Museum of Natural History, New York, to study the Kearfott types of microlepidoptera, and also the collections at the Academy of Natural Sciences, Philadelphia, to study the Clemens types.

Dr. E. D. Ball, accompanied by Dr. A. L. Quaintance, recently visited the boll weevil station at Florence, S. C., being conducted by the Bureau of Entomology in co-operation with Clemson College. A visit was also made to the extensive plant-breeding farms of David R. Coker at Hartsville, S. C.

Mr. H. G. Crawford, Entomological Branch, Ottawa, Can., spent the week of July 10th at Arlington, Mass., consulting with D. J. Caffrey in charge of the European Corn Borer investigations for the United States Bureau. The moths were flying freely at the time of his visit and an excellent opportunity was obtained to view the conditions of the infestation.

Dr. Guy A. K. Marshall, Director of the Imperial Bureau of Entomology, London, accompanied by Dr. E. J. Butler, Director of the Bureau of Botany, spent two days in Ottawa recently. Dr. Marshall and Dr. Butler were enroute to attend the Pan-Pacific conference which is to be held during the month of August in Australia.

Mr. Harry S. Smith, formerly chief of the Bureau of Pest Control, California State Department of Agriculture, has been appointed Associate Professor of Entomology of the University of California, to have charge of beneficial insect investigations, this work having been transferred to the University by the Legislature. He will be stationed at the Citrus Experiment Station at Riverside.

The following resignations from the Bureau of Entomology have been announced; W. W. Porter, sweet potato weevil, Miss.; Guy Hughes, temporary junior entomologist, Baton Rouge, La., to become principal of the Smith-Hughes High School in Louisiana; Messrs. W. V. Reed, I. J. Condit and G. E. Riley, collaborators, to enter commercial work; R. W. Wells, in charge of the ox-warble laboratory, Middletown N. Y., to engage in business.

Mr. E. J. Newcomer, of the Bureau of Entomology, stationed at Yakima, Washington, has been elected Vice-President of the Northwestern Association of Horticulturists, Entomologists and Plant Pathologists at its sixth annual meeting held at Boise, Idaho, July 23–26.

Professor George A. Dean, Professor of Entomology in the Kansas Agricultural College and Entomologist of the Agricultural Experiment Station, has been appointed Entomologist in charge of Cereal and Forest Insect Investigations, Bureau of Entomology, to assume his duties September 1. Acting on the advice of his physicians, Mr. W. R. Walton found it necessary to give up the heavy work connected with the administration of this office and has taken leave in order to recuperate in health. Professor Dean will devote considerable time this fall to visiting the various field laboratories engaged in cereal and forage insect investigations and will give special attention to corn borer operations, the grasshopper situation, Hessian fly work, etc.

Dr. F. C. Bishopp, in charge of the Dallas, Texas, Laboratory of the Bureau of Entomology, visited Washington on official business, late in June. On July 1 he left for Dallas, but was obliged to leave the train at Columbus, Ohio, and upon the advice of a physician underwent an operation for appendicitis at that place. He has sufficiently recovered to return to Dallas and resume his duties.

On March 1, 1923, Mr. J. C. Hamlin was promoted by the Australian Commonwealth Prickly-Pear Board to control the scientific investigations of that body. On June 23rd, Mr. Hamlin landed at Vancouver enroute to Uvalde, Texas, where he will carry out special work for his Board during the next few months. During Mr. Hamlin's absence from Australia, Mr. W. B. Alexander is Acting Officer-in-Charge of the Board's scientific work.

According to the *Official Record*, arrangements have been completed by which Alexander Znamensky, a Russian entomologist, will be employed by the Bureau of Entomology for a year to conduct investigations in southern Russia to determine whether parasites likely to be useful against the Japanese beetle can be found there and shipped to the infested areas in New Jersey. Species of beetles closely related to the Japanese beetle are known to occur in southern Russia. Mr. Znamensky will be located at Poltava or Stavropol.

Messrs. C. P. Clausen and J. L. King, who have been in Japan seeking parasites of the Japanese beetle, have been heard from since the earthquake. They were away from Yokohama, and are safe. Dr. D. T. Fullaway was also in Japan for a short time, but resigned and returned to Honolulu before the earthquake. Dr. J. F. Illingworth is also in Japan, and has not been heard from, but it is assumed that he was away from the scene of the earthquake on a collecting trip.

Transfers in the Bureau of Entomology have been announced as follows: Dr. A. D. Hopkins, formerly in charge of Forest Insect Investigations, is now to devote all of his time to research in connection with bioclimatics; on July 1, Mr. S. A. Rohwer was transferred from Forest Insect Investigations to the miscellaneous fund for duty in the U. S. National Museum; Perez Simmons and George W. Ellington from Washington, D. C., to Sligo, Md.

Professor J. G. Sanders, formerly Director of the Pennsylvania Bureau of Plant Industry, who refused to submit to heavy reductions in funds for quarantine work on Japanese beetle, potato-wart, European Corn Borer, etc., by a new Secretary of Agriculture wholly unfamiliar with the work, has left the state department and become Manager of the Spray Oil Department of the Sun Oil Company of Philadelphia, manufacturers of their new self-emulsifying spray oil.

According to *Science*, fetes began on August 6 at Millau (Aveyron) in honor of Fabre, the famous French entomologist. A monument, the work of the sculptor Malet, representing Fabre, a magnifying glass in his hand, examining an insect, was unveiled. It was actually at St. Léons that Fabre was born, but St. Léons is a little village of a few hundred inhabitants, and it was thought desirable to erect the statue in the neighboring town of Millau. Fabre is chiefly associated with Serignan, near Orange, for it was here in his garden that he pursued his entomological studies.

It is announced that one of the parasites recently introduced from Europe as an enemy of the European Corn Borer, namely *Exoristus roborator* Fab., has been recovered from the field by the collection of corn borer larvae from which the parasite has been reared. It seems extremely probable, therefore, that this species has succeeded in establishing itself in this country. The recovery of this parasite is recorded from five or six different localities.

Mr. E. G. Smyth of the Bureau of Entomology, has left Guatemala for Mexico, where he will investigate the bean beetle situation in the area between Mexico City and Vera Cruz, with especial attention to the localities in the vicinity of Jalapa and Cordova. This region is at the edge of the Mexican plateau, and it is hoped that any parasites collected in this vicinity will be more easily adapted to the climatic conditions in the southeastern portion of the United States.

In response to a request from the National Park Service, Mr. J. C. Evenden left the Forest Insect Field Station at Coeur d'Alene, Idaho, June 6, to make an examination of serious defoliation apparently caused by the spruce budworm in the vicinity of the Tower Falls and Camp Roosevelt section, Yellowstone National Park. On his return Mr. Evenden will make an examination of a Dendroctonus control project near Boise, Idaho, which is being conducted by means of logging, and also an area defoliated by the white pine butterfly. The Dendroctonus control project on the Helena National Forest was completed May 26. Approximately 500 trees were treated.

Mr. J. R. Douglass, formerly connected with the Mexican bean beetle laboratory, Bureau of Entomology, at Birmingham, Ala., has established headquarters at Estancia, N. Mex., for the study of the Mexican bean beetle under western conditions. He reports that the dry conditions which existed during the summer of 1922 and most of last winter are continuing to some extent, and the acreage of beans has been greatly reduced. Apparently the beetles are appearing from hibernation in much smaller numbers than usual—a condition which has also been reported farther south in New Mexico by Dr. Robert Middlebrook. It appears that the dry weather of last summer, together with the cutting-off of their food supply, has influenced this unusual condition.

On June 22 Miss Isabel Cooper, scientific assistant of the Williams Galapagos Expedition, brought to Washington for identification the Heterocera and Hymenoptera secured by this expedition. It is understood that the types of all the new species are to be retained for the National Collection. These collections will be studied by Mr. Schaus and Mr. Rohwer. At the same time Miss Cooper took away several thousand Lepidoptera which had been secured by William Beebe while working at the British Guiana Experiment Station. These specimens had been identified by Mr. Schaus and are being returned to the New York Zoological Society for their collections. The work at the British Guiana Experiment Station and also the work done by the William Galapagos Expedition is carried on under the direction of William Beebe, with headquarters at the New York Zoological Gardens.

On July 25th, about 25 representatives of the Federal Horticultural Board, Bureau of Entomology, and several near-by States, visited the Japanese Beetle Laboratory at Riverton, N. J., and apple and peach orchards in the vicinity. At a conference in the afternoon, C. H. Hadley and L. B. Smith explained the various phases of the

work, and remarks were made by Professors E. N. Cory, State Entomologist of Maryland, and W. J. Schoene, State Entomologist of Virginia. In addition to the laboratory staff, the following were present: Dr. A. L. Quaintance, Bureau of Entomology, Dr. K. F. Kellerman and G. B. Sudworth, Federal Horticultural Board, Washington, D. C.; Professor W. J. Schoene, Blacksburg, Va.; Professor E. N. Cory and C. C. Hamilton, College Park, Md.; Professor Wesley Webb, Dover, Del.; Professor H. E. Hodgkiss, State College, Pa.; Messrs. Frank P. Willits, John M. McKee and W. A. McCubbin, State Department of Agriculture, Harrisburg, Pa.; Dr. T. J. Headlee and H. B. Weiss, New Brunswick, N. J.

Mr. L. S. McLaine of the Entomological Branch, Ottawa, Can., returned on July 23rd from an inspection trip to western Canada. During his absence he visited the new fumigation and inspection building at Vancouver. The new station is of hollow tile construction, covered with cement, and measures fifty by one hundred feet. It contains four fumigation chambers and in addition the large inspection and packing rooms are so constructed that they can readily be used for fumigating grain and other products. Three hundred and fifty tons of grain can be treated at one time. Arrangements were made with the British Columbia authorities in regard to carrying out the new Regulations under the Destructive Insect and Pest Act. The Satin Moth situation was also looked into. The laboratories maintained by the Branch at different points were also visited. The alfalfa weevil scouting work in southern Alberta and the inspection work at Winnepeg were discussed with the officials in charge of these duties.

The following appointments have recently been announced in the Bureau of Entomology: Temporary employees, Boll weevil laboratory, Tallulah, La., Wm. C. Gideon, Jos. Nolan Harvey, Jr., Sterling B. Hendricks, L. P. Hodges, Albert L. Monroe, R. W. Necaise, Sherrill Sevier; tobacco insect laboratory, Clarksville, Tenn., L. N. Judah, Scott C. Lyon, F. C. Plummer, W. B. Weakley; screwworm substation, Uvalde, Tex., Graden Barnett, H. L. Weatherby; Mexican beetle, Birmingham, Ala.; John P. Wemple, junior entomologist, Baton Rouge, La.; temporary, boll weevil force, Florence, S. C.; E. D. Bateman, L. L. Benton, C. A. Bolt, Wm. H. Craven, G. E. Hawkins, M. B. Hoffman, J. H. Hunter, A. K. Inman, M. L. Jones, J. G. Lewis, C. Ling, K. M. Mace, T. G. Martin, M. C. Martin, R. L. Martin, A. L. McCrary, W. D. McGowan, L. G. McGraw, J. L. Nichols, D. L. Outen, S. D. Reid, T. D. Rickenbaker, Wm. J. Roberts, T. S. Smith, R. W. Moreland, J. N. Todd; John Cotton, Robert M. Fouts; Dr. Carroll G. Bull, temporarily, to do serological work in connection with the investigations of malaria mosquitoes.

A conference of entomologists concerned with the European Corn Borer problem was called to meet at the Experiment Station, Wooster, Ohio, June 29, by Director Truax of the State Department of Agriculture. Present at the conference were Director Truax, Director Williams of the Experiment Station, Dr. Herbert Osborn of Ohio State University, R. D. Faxon, chief of the State Bureau of Entomological Inspection and Quarantine; H. A. Gossard, J. S. Houser, L. L. Huber, C. R. Neiswander and C. R. Cutright of the Experiment Station. E. G. Brewer in charge of the Federal quarantine for Ohio and adjacent areas was unavoidably absent, but sent an able assistant in Mr. Fall, who outlined fully the methods and plans of the Federal Service for the coming season. All present participated in the discussion. Special praise was given to the effective clean-up campaign put on in Ashtabula County last

spring by Professor T. H. Parks and County Agent Sleeth. Mr. Huber was able to report gratifying progress at the laboratory in starting off the life-history studies and carrying through in full to date the whole experimental program outlined in the spring. Director Truax read a letter of regret from Governor Donahey that he was unable to be present. The Governor, Director Truax and Director Williams all gave assurance of their support of the work under way.

The Federal Horticultural Board held a conference at the State House, Boston, Mass., on August 17, in regard to the Federal inspection and certification of stock to be shipped out of nurseries within the gipsy moth quarantined area. Some shipments sent into other states during the past season were found infested, most of them emanating from one nursery. The speakers included Federal and State Inspectors, Commissioners of Agriculture and nurserymen. The concensus of opinion was that each nurseryman should be responsible for keeping his own nursery clean and should carry out all methods of treatment necessary to that end: that the State authorities should give inspections and advice and direct clean-up campaigns around the nurseries to aid in the work: and that Federal inspection and certification would be refused at all nurseries not granted a State certificate. The following entomologists were present: Dr. L. O. Howard, Dr. A. L. Quaintance, Dr. C. L. Marlatt, E. D. Ball, Washington, D. C.; Mr. A. F. Burgess, D. M. Rogers, J. N. Summers, C. W. Collins, H. L. Blaisdell and S. S. Crossman of the Federal gipsy moth force; Mr. R. I. Smith and L. M. Scott, Plant Quarantine Inspection Service; W. C. O'Kane, State Entomologist, Durham, N. H.; W. E. Britton, State Entomologist, New Haven, Conn.; A. E. Stene, State Entomologist, Harry Horovitz and R. A. Sheals, Assistant, Providence, R. I.; Mr. H. L. McIntyre, B. D. Van Buren and A. M. McDonald, Conservation Commissioner, Albany, N. Y.; R. H. Allen, Q. S. Lowry, George A. Smith, Dr. A. W. Gilbert, Commissioner, State Department of Agriculture, Boston, Mass.; Dr. Thomas J. Headlee, State Entomologist, New Brunswick, N. J.; Mr. C. H. Hadley, Director, Bureau of Plant Industry, Harrisburg, Pa.; George A. Dean, State Entomologist, Manhattan, Kan.

A party of Ohio Entomologists and other state and county officials visited Port Stanley, Ontario, Canada, September 7-8, to observe the corn borer damage there and to study the control methods being used against this pest by the Canadians. The party was met by the Canadian Entomologists, with whom a joint session was held the evening of September 7th. On the 8th, a field trip was made under the supervision of the Canadian Entomologists. The party crossed Lake Erie on the State Fisheries Boat, Oliver H. Perry. The following entomologists were in the party: Herbert Osborn, Columbus, Ohio, Harrison Garman, Lexington, Ky., Erle G. Brewer, Cleveland, Ohio, C. O. Larrabee, Cleveland, Ohio, T. H. Parks, Columbus, Ohio, P. A. Howell, Cleveland, Ohio, F. W. Poos, Sandusky, Ohio, Raymond C. Osburn, Columbus, Ohio, Frank N. Wallace, Indianapolis, Ind., Geo. N. Dean, Washington, D. C., W. H. Larrimer, Lafayette, Ind., J. S. Houser, Wooster, Ohio, D. M. DeLong, Columbus, Ohio, N. E. Shaw, Columbus, Ohio, Richard Faxon, Columbus, Ohio, L. L. Huber, Geneva, Ohio, C. R. Neiswander, Geneva, Ohio, H. A. Gossard, Wooster, Ohio, D. J. Caffrey, Arlington, Mass., and M. D. Leonard, Albany, New York.

Horticultural Inspection Notes

Mr. George H. Russell, who for the past year has been stationed at New Orleans, Louisiana, has temporarily taken over the work of the Federal Horticultural Board in Galveston. He will later proceed to Del Rio, Texas, to assist in the enforcement of the Board's regulations.

The Federal Horticultural Board will open the port of Astoria, Oregon, for the entry of agricultural products under permit. The work at that port will be in charge of Mr. W. H. Freeman who has had many years' experience in plant quarantine work.

Mr. Harry B. Shaw, Pathologist in Charge of the Office of the Federal Horticulcural Board in New York, attended the meeting of Phytopathologists held in Geneva, New York from July 9 to 13.

Messrs. R. D. Kennedy and R. G. Cogswell and J. W. O'Brien, inspectors of the Federal Horticultural Board stationed in New York have discovered six shipments of narcissus bulbs arriving from France slightly infested with larvae of the Lesser Bulb Fly.

Mr. Horace S. Dean, a graduate of the University of Tennessee, was recently appointed Plant Quarantine Inspector with headquarters at Washington, D. C., for the purpose of assisting in the pathological inspection of imported plants and plant products. He will also assist in the sterilization studies now being conducted for the purpose of determining a satisfactory treatment of infected plant material.

Professor R. Kent Beattie, Pathologist in Charge of the Office of Foreign Plant Quarantines, is making his annual inspection, on the west coast, of plants introduced under special permit. A similar inspection is being conducted in the East by Messrs. N. Rex Hunt and J. M. R. Adams.

Mr. Roberts G. Cogswell, who has for the past three years been assisting in the inspection work at the port of New York, was recently transferred to Washington for the purpose of assisting in the examination of plant material.

Mr. Clyde P. Trotter, who is in charge of the Board's activities in Galveston, Texas, recently visited Port Arthur, Beaumont, Orange, Sabine, and Pt. Neches, Texas, to determine the number of foreign ships arriving at those ports and the possibilities of contraband materials arriving on such vessels, either as ship's stores or passengers' baggage.

At the request of Commissioner Harry D. Wilson of the Louisiana State Department of Agriculture and Immigration, a conference to discuss the present camphor scale situation was held in New Orleans on August 6. This conference was attended by state officials of Louisiana, Mississippi, Alabama, and Texas, as well as several representatives of the Bureau of Entomology and the Federal Horticultural Board. Immediately following the conference, the visitors were conducted by representatives of the Bureau of Entomology through the heavily infested portions of Audubon Park to see the work of the camphor scale and the results of experiments in its control.

The port of Detroit was recently visited by Mr. E. R. Sasscer, Entomologist in Charge, Plant Quarantine Inspection Service, Federal Horticultural Board, for the purpose of determining the advisability of placing an inspector at that port to assist the Custom officials in the enforcement of the various quarantines promulgated by

the Board. As a result of this trip, it was evident that the work at that port was not sufficiently important to warrant the placing of an inspector there permanently. Arrangements were made, therefore, with Mr. J. W. Enwright of the Bureau of Entomology to serve as a collaborator of the Board, especially during the bulb shipping season.

On August 5 a passenger arrived at New Orleans from Antwerp, Belgium, having in his baggage ten cotton samples collected from various sections of South Africa, China, and Brazil. The owner proposed to take them to Dallas, Texas and Atlanta, Georgia. Upon examination the samples were found to contain some two hundred and fifty seeds. After a full explanation of the quarantine was made, the passenger willingly consented to the destruction of the entire lot of samples.

On August 28, Mr. Ivan Shiller, an inspector of the Federal Horticultural Board located in New York, discovered that the S. S. Ponce, arriving from Porto Rico, contained 1650 bags of cotton seed for trans-shipment and export to Glasgow, Scotland. Upon examination, this seed was found to be infested with the larvae and pupae of the Pink Bollworm. Mr. Shiller supervised the unloading of the seed and the cleaning of the hold of the vessel.

Mr. L. R. Dorland, the inspector in charge of the work of the Federal Horticultural Board at Nogales, Arizona, recently visited Douglas and Naco, Arizona for the purpose of conferring with Custom and railroad officials. Incidentally, while at these ports he secured figures on the amount of foreign business conducted at those ports, and information concerning the danger of introducing plant pests in commodities arriving from Mexico.

A large amount of Italian broom corn is entering Canada through the port of Boston where it is being treated for the European Corn Borer. The work of this pest is very evident in many shipments but no living larvae have been discovered by Canadian inspectors.

Inspectors Beaulne and Cameron in Montreal, and Ryan and Gibson in Toronto, have been examining cars of Jamaica bananas, which were transhipped at Philadelphia on account of the danger of their being infested with Japanese Beetle. Large flights of this insect were reported as occurring around the docks at the time the Jamaica boat was unloading.

Apicultural Notes

The annual picnic of the Allegheny County Beekeeper's Association of Pennsylvania was scheduled to be held at West End Park, Pittsburgh, Pa., Saturday, September 8. The Secretary is Mr. A. T. Keil, Glenfield, Pa.

The annual meeting of the Alabama Beekeeper's Association was scheduled to take place in the Chamber of Commerce Auditorium, Montgomery, Ala., on Friday September 13. Mr. M. C. Berry, Hayneville, Ala., is Secretary of this Association.

A mass meeting for Ohio beekeepers was held in the Horticultural Building at the Ohio State Fair, Columbus, Ohio, on Friday, August 31. The problems connected with the eradication of American foul brood in Ohio were discussed.

Dr. A. P. Sturtevant, Apicultural Assistant in charge of Bee Disease Investigations, of the Bee Culture Laboratory of the Bureau of Entomology, has resigned to accept the position of Assistant Professor of Bacteriology at the New York Homeopathic Medical College, New York City.

Mr. Martin H. Cassidy, instructor in beekeeping at the Massachusetts Agricultural College, Amherst, Mass., and Mr. S. H. White, one of his students, attended the Wisconsin Beekeeper's Chautauqua and the dedication of the Miller Memorial Library at Madison, Wis., August 13–16. They made the trip by automobile, and returned via Medina, Ohio, visiting the apiaries and factory of the A. I. Root Company.

The Miller Memorial Library of Beekeeping was dedicated and formally turned over to the University of Wisconsin on the morning of August 17. Mr. C. P. Dadant, chairman of the Committee made the presentation address. President E. A. Birge on behalf of the University, made the address of acceptance. Other addresses were made by Mr. E. R. Root, Dr. E. F. Phillips and Mr. B. F. Kindig of the Committee, and Mr. N. E. France. This occurred at one of the most important and best attended beekeepers' conferences ever held. About one thousand volumes are already in the library and an endowment for it is being created by beekeepers who have profited by the teachings of Doctor Miller. Books and magazines are being contributed to the library by European and American beekeepers.

The members of the Maryland State Beekeeper's Association visited the Bee Culture Laboratory of the Bureau of Entomology, Washington, D. C., on July 28. Rain prevented any outdoor demonstrations, but a goodly sized crowd gathered to hear the program given by the laboratory staff. The following papers were presented: "Hourly Weight Changes of a Scale Colony" by J. I. Hambleton; "Studies of a Colony in an Observation Hive" by Bruce Lineburg; "American Foul Brood" by A. P. Sturtevant; "Language of the Bees" by Archie Shaftesbury; "A Brood-Rearing Curve" by W. J. Nolan; "Moulting of Larvae" by L. M. Bertholf; "Color of Honey" by Bernard Kurrelmeyer.

Notes on Medical Entomology

The City of Fredericton, N. B., has been carrying on a mosquito control campaign under the direction of Dr. J. D. Tothill. The spring floods left an unusual number of breeding pools in the Fredericton district and very satisfactory results were obtained through oiling.

Dr. L. O. Howard has recently published an article entitled "A Fifty-Year Sketch-History of Medical Entomology" in the Annual Report of the Smithsonian Institution for 1921, pages 565–586, 10 plates. The plates are portraits of Sir Patrick Manson, Sir Ronald Ross and Doctors A. Laveran, G. B. Grassi, A. Celli, Carlos J. Finlay, Walter Reed, J. C. Carroll, J. W. Lazear, and Howard T. Ricketts.